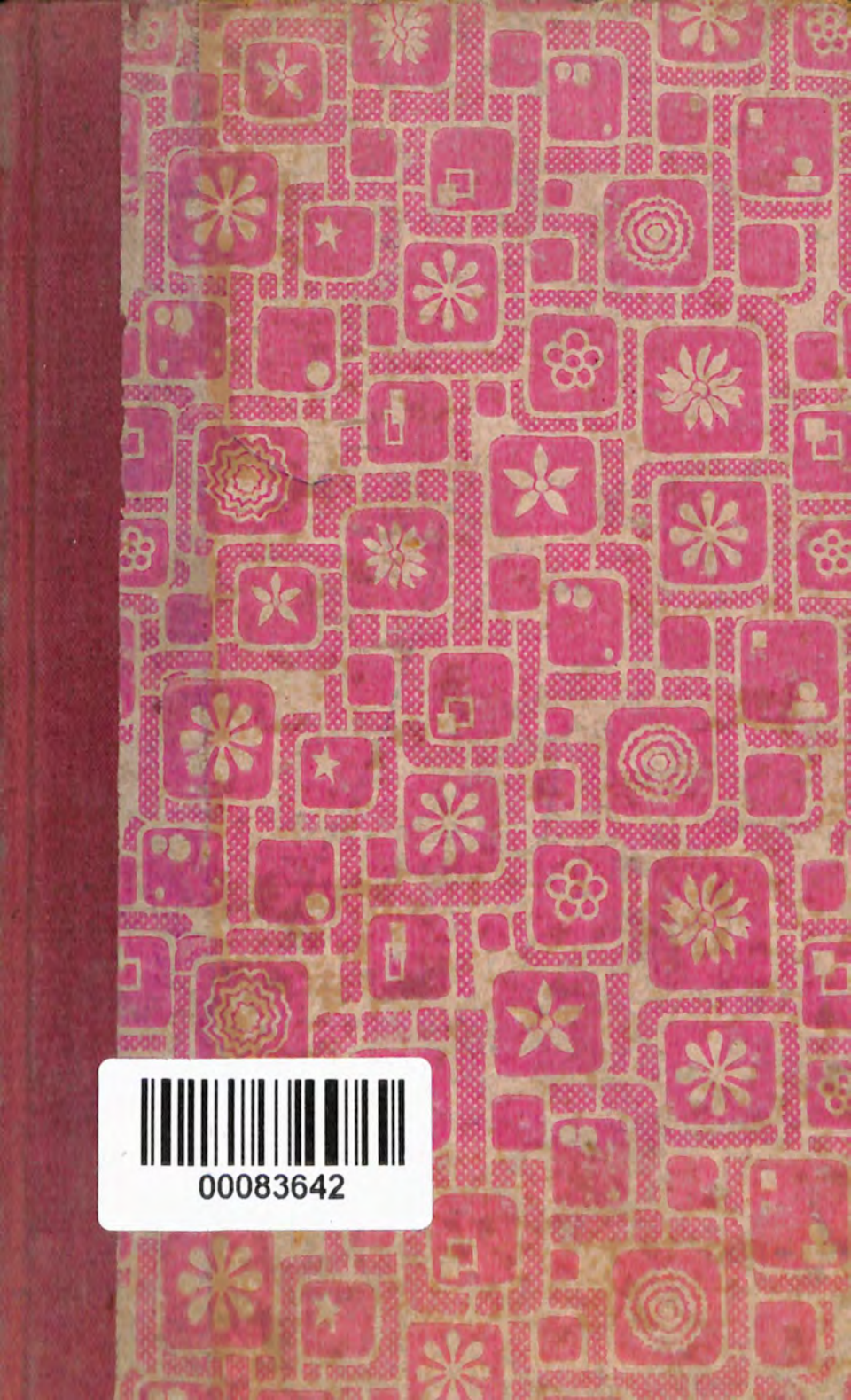
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TRAVELS,

COMPRISING

OBSERVATIONS MADE DURING A RESIDENCE

IN

THE TARENTAISE,

AND VARIOUS PARTS OF THE

GRECIAN AND PENNINE ALPS,

AND IN

SWITZERLAND AND AUVERGNE,

83642

IN THE YEARS

1820, 1821, AND 1822.

ILLUSTRATED BY COLOURED ENGRAVINGS AND NUMEROUS WOOD CUTS,

FROM ORIGINAL DRAWINGS AND SECTIONS.

BY R. BAKEWELL, ESQ.

Ignotis errare locis, ignota videre
Flumina gaudebat, studio minuente laborem. OVID.

IN TWO VOLUMES.

VOL. I.

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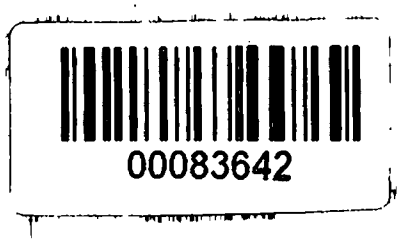

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PREFACE.

THE observations contained in the first volume of these travels were made during a residence of four months in the Tarentaise, and various parts of Savoy, which have hitherto been scarcely explored by my countrymen, who generally follow each other along the most frequented route, in one unvaried track. I trust, therefore, that a description of this interesting country and the state of its inhabitants, with a comparative view of its geology, may be favourably received. The only part of Savoy well-known to the English is Chamouny, and this I should have passed over in silence, had not my views of its geology been different from those generally entertained.

Indeed, since the time of Saussure, when the study of the secondary strata was in its infancy, little farther has been done to illustrate the geology of Savoy, nor has any thing been published respecting it that I know of, by the numerous English travellers who have visited Chamouny. The same remark will apply, in a certain degree, to the canton of the Vallais, and other parts of Switzerland described in the second volume.

I believe no English travels contain an account of the ancient volcanoes in Auvergne*, nor to my knowledge have any views or sections ever been published of the volcanic country round Clermont. The description of a part of this district, with the explanatory section and outlines, will, I hope, convey a tolerably correct idea of its present state and appearance.

* On my return to England, I found that Dr. Daubeny had published a short account of the volcanoes of Auvergne, in the Edin. Phil. Journal, Vol. II. and III. 1820, 1821, but without any drawings or sections.

Excepting Geneva, those parts of my route that have been much frequented, I have seldom noticed, unless where facts or circumstances presented themselves that are not generally known, or that appeared to possess sufficient interest to be placed before the reader.

The range of country travelled over may be thought limited, compared with the time that I was on the continent, but I have rarely given any account of places where I did not reside some days or weeks, or had not the opportunity of making repeated observations, as I have too frequently found how much correction, first observations require. I speak this in reference only to myself, for I envy the amazing powers of those travellers who can fly through a country with the rapidity of a swallow, and see at one intuitive glance the details of its geology, or the state of society in all its ramifications. What delightful emotions must press on the mind of such a tourist, when he draws on his "seven-leagued

boots," and prepares for a journey which may rival the march of Neptune, when, as Homer tells us,

> "From isle to isle three ample strides he took,
> "And at the fourth the distant Ægе shook."

Persons of more limited powers are compelled to admit, that for all the useful purposes of travelling, *time* is as essential an element as *space*.

It may, perhaps, be thought that it was unnecessary to devote several pages to the little Republic of Geneva, but a residence of two winters in that city, convinced me that though much had been written respecting it, the state of society there, was but imperfectly known in England, and had been much misrepresented.

A writer of some note has lately told the public, that he should prefer living among the Turks to a residence in Geneva. I am not in the least degree desirous of influencing the opinions of this writer, nor of those who may coincide with him; for

if any one prefer the society of ferocious and ignorant slaves, to that of intelligent freemen, I heartily wish him to enjoy all the advantages he can possibly derive from such a preference.

Several recent events that have taken place in Geneva, have excited great interest among a certain class of my countrymen; and as this city is at present much resorted to by English families, as a place of temporary residence, and many young Englishmen are sent there for education, I thought it would be useful to state its advantages or inconveniences, in respect to either of these objects.—I have endeavoured to do this impartially, but much diversity of opinion will prevail, according to the views or prejudices of different parties.

For the benefit of those who may feel no interest in geological enquiries, I have most frequently separated the observations that relate solely to geology from other subjects; but as this could not always be conveniently done, I have hung out

lights at the head of the page, to warn the reader when he is coming near the rocks. In the drawings and sections from which the engravings and cuts were made, it was my principal aim to preserve a faithful outline of the objects represented: the views of Château Duing and the evaporating-house, near Moutiers, were taken by Mrs. B.; the section of the strata near Bex, is copied from one by Monsieur Charpentier.

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Page 333. *for* CHAP. IX. *read* CHAP. X.

EXPLANATION

OF

THE PLATES AND CUTS.

The Baths of Brida, in the Tarentaise.

THE houses in front are a part of the boarding-houses.—The Baths are situated about half a mile higher up the valley, and close to the bed of the river, but are not visible from this station.—The mountain on the right, which is truncated, or nearly flat at the top, is called the *Pan de Sucre*, or Sugar Loaf; it is about seven miles distant from the station. This mountain is composed of granular gypsum, which, when broken, is as white as the finest loaf-sugar. The singular Peak beyond the Pan de Sucre, with two points at the summit, is considerably higher than the Pan de Sucre, but it is more than six miles beyond it. This peak appears isolated, but it is connected by a range of rocks behind, with the snow-capped mountains called in this valley, the *Planey*. The distance of the Planey from the station where the drawing was taken, may be about fifteen miles. As the lower line of perpetual snow, in this part of Savoy, is about 8000 feet above the level of the sea, the height of this mountain cannot be less than about 12,000 feet; the drawing was taken in the month of August 1821. The village of Villard Goi-

treu is situated near the foot of the Pan de Sucre. The mountain on the left is capped with gypsum. The feet of the nearer mountains are in many parts covered with gypsum and planted with vines. The white line, descending from the snow into the valley, is the bed of a torrent, partly filled with snow and ice.

Château Duing and the Dent d'Alencon, on the Lake of Annecy.

This view has been described in Chapter I. and II. of the present volume; but it may be proper to notice that the lake, which appears to terminate here, passes on the other side of the Château, and extends southward, and is surrounded by the singularly-shaped mountains, of which an outline is given, page 42, but which is less distinct than was intended, owing to the shading in the back ground. In the strata at the foot of the Dent d'Alencon may be seen an instance of the curved stratification, so common in the calcareous mountains of Savoy. The profile of the Dent d'Alencon is represented, page 62.

The Aiguille de Dru, Chamouny,

Represents this extraordinary pyramid of granite, as seen in going to the source of the Arveiron; the mountain behind it is the Aiguille Vert, one of the highest pinnacles in the Alps; it is connected with the Aiguille de Dru by a narrow ridge of rocks, which cannot be seen in this view. The Glacier de Bois, which is seen descending into the valley, is a continuation of the Mer de Glace.

The Gibbon-Horn.

This view of the mountain, south of L'Hopital, is merely intended to give a faithful outline, representing

it as seen in shade, in the evening; in the morning, when the south side of the mountain is illuminated, the inequalities of its surface are visible and destroy the effect of the contour.

The cut of Mont Grenier, Vol. I. Page 199., is intended to represent a part of that mountain, seen at the distance of about three miles from its base; it was taken among the heaps of fragments, which are the remains of the great eboulement.

The section of the coal strata, on the Lake of Annecy, Vol. I. Page 186., represents the southern end of the mountain. The coal mine, at present worked, is situated north of the line, D D, or behind the station whence this section was drawn.

In the Evaporating House at Moutiers, called *Maison d'Epines*, represented Page 230. Vol. I., the building should have been drawn more than double its present length, to preserve the just proportions, but as the length of the page did not permit this, without reducing the drawing too much to be distinct, the reader must conceive each wing to be extended. The evaporating houses for the higher degrees of concentration, resemble this in every respect, except that they are only half the length, and have a roof.

The other Cuts are sufficiently described in the text, but it may be useful to state the pages where they occur.

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INTRODUCTORY OBSERVATIONS

ON THE

PHYSICAL GEOGRAPHY

OF

SAVOY.

When the Romans first extended their conquests to the northern side of the Alps, the Allobroges, one of the most powerful nations of ancient Gaul, possessed the province of Dauphiny, and a great part of what is now called Savoy; the Centrones, a warlike tribe, occupied the other part, together with the lower Vallois. After the Roman conquests, the name of Sabaudia*

* Ammianus Marcellinus, who wrote in the fourth century, speaking of the course of the Rhone, says, "qui per Sabaudiam fertur et Sequanos." The present king of Sardinia stiles himself Dux Sabaudiæ.

was given to a part of this country bordering on the Rhone, and in the tenth century it was called Savogia and Savoia; it was governed by counts, at the latter period, and then comprised only the western provinces of the present duchy of Savoy.*

By subsequent conquests and alliances, the counts of Savogia brought under their dominion several adjoining provinces, on the northern side of the Alps. In the year 1416, the emperor Sigismund erected Savogia into a duchy, which the dukes held under the empire. At that time the Pays de Vaud, and the country of Gex, under the Jura, also belonged to the dukes of Savoy.

According to its present limits, the duchy of Savoy is bounded on the north by the Lake of Geneva and the Rhone. It is separated, on the east, from the Swiss canton of the Vallois, by a range of mountains, extending south from St. Gingoulph, near the upper end of the Lake of Geneva, to the Col de Ferret in the central range of the

* Excepting a small section, of about eight miles in length, and three in breadth, which was taken from Savoy and annexed to the republic of Geneva in 1816.

Alps. This central range, from the Col de Ferret to Mont Cenis, forms the southern boundary, separating Savoy from Piedmont. Savoy is partly separated from France by the Rhone, which forms the western boundary, soon after it issues from the Lake of Geneva, until it reaches St. Genix, where it leaves the confines of the two countries, and enters France. From Genix the line of demarcation is carried along the river Guiers, and then on the south-western side of the mountains that bound the valley of the Maurienne, until it joins the central range of the Alps near Mont Cenis. There is no well defined natural boundary on this side of Savoy. The duchy extends from near latitude 45° to 46°. 21′. Its greatest length, from north to south, is about 85 miles; and its average breadth, from east to west, from 50 to 60 miles. The central range of the southern Alps, passing along the southern boundary of Savoy in a bending line of 100 miles in length, comprises that portion of the vast chain of mountains known to the Romans by the name of the Grecian Alps, together with a part of the Pennine and Cottian

Alps.* The highest summits, as the Aguille Vert, Le Geant, Mont Blanc, and Mont Iseran, are situated along this part

* As modern writers on the continent, as well as ancient historians, use the Roman appellations to designate certain parts of the Alps, it may be proper to state that the Romans, who made military roads to pass over these mountains into Gaul and Germany, denominated different portions of this range from the people who inhabited the country near these roads, or from the heroes, by whom, according to tradition, the Alps had been first crossed. See Plin. Nat. Hist. lib. iii. cap. 23.

The LIGURIAN, or MARITIME ALPS, and the COTTIAN ALPS, separate France from Italy on the south-east. The ancient nation of the Ligurians inhabited the Italian side of the Alps. The Cottian Alps, so called from Cottius, the friend of Augustus, extended to Mont Cenis, comprising also the lateral valleys that branch from that mountain.

The GRECIAN ALPS extended from the east of Mont Cenis to the Col de Bon Homme, beyond the little St. Bernard: Pliny says they were so called from Hercules, who first passed over them.

The PENNINE ALPS, or SUMMÆ ALPES, comprised the mountains and valleys from the Col de Bon Homme to the Great St. Bernard, and eastward to the mountains of the Haut Vallois. On the Great St. Bernard, the inhabitants of the country are said to have adored the god Pen, under the form of a young man. The Romans afterwards converted this god into Jupiter Penninus. The word Pen, or Ben, was the name of a high mountain among many of the northern nations of Europe: thus we have, in England, Pennygent, Pendle-hill, Pengaen, &c.; and in Scotland, Ben Lomond, Ben Nevis, &c. &c.

of the central range within the limits of the dutchy, rising several thousand feet above the lower line of eternal snow.

The lateral valleys that branch into Savoy from the central chain of the Alps, are bounded by mountains that decrease in elevation as they recede from the south. Thus, while the mountains in or near the central range rise from ten to fourteen thousand feet above the level of the sea, those near the northern boundary, or the basin of the Lake of Geneva, scarcely rise higher than from three to five thousand feet. The whole of Savoy may be said to be covered with mountains, intersected by deep valleys; no part of it can properly be called a level country; but on the western side, some of the valleys open out to the breadth of several miles. There are other valleys, so entirely bounded and closed in by mountains, as to be insulated by nature from the world, having no outlet except a deep gorge or chasm, from

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The LEPONTINE ALPS extended from St. Plomb to St. Gothard, along the Haut Vallois.

The RHÆTIAN ALPS comprised the country of the Grisons, the Tyrol, and Trient.

The JULIENNE, or NORIC ALPS, comprised the chain of mountains extending through Friuli, the lower Austria, and Istria.

whence the water issues, but which was too narrow to admit of an entrance, until the labour of man had widened the passage. As the mountains recede from the central range, their summits come below the line of eternal snow; and where the rocks are not too steep to admit of a covering of soil, they are clothed with verdure or forest trees. The fir grows nearly to their summits, and the intermediate declivities of these mountains, though too elevated for culture, afford a summer pasture for cattle. The lowest hills and slopes, and the bottoms of the valleys, are the only parts that can be cultured by the plough or spade.

Perhaps the following statistical account of the division of the ground, in two of the most alpine districts of Savoy, may convey a more correct idea of the nature of the country, than can be obtained from a general description. It is taken from an actual survey and register of all the land in Savoy, which was made by order of the government in the year 1738; and these divisions, being traced by nature, remain nearly the same at the present time.

The Tarentaise: —	Square Journals of Piedmont.
Land in culture - -	146,223
Pastures and commons -	200,012
Rocks, glaciers, beds of rivers, and land covered by eboulements -	99,388
Total of land -	445,623

The Maurienne: —	
Land in culture - -	242,041
Pastures and commons -	178,601
Rocks, glaciers, beds of rivers, and land covered by eboulements - -	101,620
Total of land -	522,262

Under the common land, the forests must be included.

It may be seen, that in these districts the proportion covered by bare rocks, stones, and glaciers, is equal to one-half of the surface capable of culture. If Savoy had been placed in the latitude of England, nearly the whole country would, on account of its elevation, have been doomed to eternal sterility, however fine the soil might be; as the lowest valleys in Savoy are more than one thousand feet above the level of the sea, and an increase of one degree of north

latitude corresponds in temperature with about three hundred feet of elevation. Thus, mountains having an elevation from 2500 feet to 3000 feet, in Savoy, have a mean temperature, equal to the plains on the eastern side of England.

The following table of the height at which different vegetables and trees are cultivated, or will grow, may serve as an index of the temperature of the Haut Vallois and of Savoy. The two countries adjoin; a great part of both are in the same parallel of latitude, and they are both bounded on the south by the central chain of the Alps. In the Vallois the line of vegetation has been attentively examined, and is given below, in English feet. It must be observed, that where the extreme height is given at which plants and trees can grow, it should be understood to imply in situations exposed to the southern and western sun, and sheltered from the Bise, or north-east wind, as the extreme line of vegetation in the same latitude varies with the aspect very much in an alpine country.

	English feet above the level of the sea. Lat. 45½ to 46½
Vines will grow -	2380
Maize - - -	2772

	English feet above the level of the sea. Lat. $45\frac{1}{2}$ to $46\frac{1}{2}$
The oak	3518
The walnut tree	3620
The yew tree	3740
Barley	4180
The cherry tree	4270
Potatoes	4450
The nut tree	4500
The beech tree	4800
The mountain maple	5100
The silver birch tree	5500
The larch tree	6000
The fir le sapin	6300
Pinus cembra	6600
The Rododendron	7400

The line of trees extends to the height of 6700 feet above the level of the sea, and the line of shrubs to 8500 feet. Some plants, on a *granitic* soil, grow at the height of 10,600, above which are a few lichens; and vegetation ceases entirely at the height of 11,000 feet. In the garden of the inn, kept in summer at the Schwarrenbach, on the passage of the Gemmi, carrots, spinnage, and onions are cultivated at the height of 6900 feet.

In the southern part of Savoy we may estimate the height at which vines will grow at 2600 feet, but near this elevation

I observed the crops had all failed in the cold summer of 1821.

I believe the greatest height at which oats are cultivated in England does not exceed 1200 feet: sheep graze on the summit of Helvellyn, which is 3052 feet above the level of the sea, and is covered with herbage.

All the rivers and lakes of Savoy empty themselves into the Rhone, or the Isere; and the latter river falls into the Rhone, at Valence. The three principal rivers are the Arch, which rises on the west side of Mont Iseran, and takes a nearly circular bend through the valley of the Maurienne, along a course of about sixty miles, before it joins the Isere. The Isere, which rises on the east side of Mount Iseran, and flows through the Tarentaise, where it joins the Arly, and turning westward, runs along the great valley of Savoy till it enters France: its course through Savoy is about seventy miles. The Arve, which rises from the glaciers of Chamouny, and after receiving all the waters from the north side of Mont Blanc, and a number of lateral valleys in its course, joins the Rhone about

one mile below the issue of the latter river from the Lake of Geneva. As the waters of the Arve come in a rapid descent from the glaciers, they preserve a temperature considerably below that of the Rhone: in summer, the difference exceeds 15° of Farenheit, and this difference occasions a proportionate increase of specific gravity, from which cause it is that the two rivers, after their junction, do not blend their waters together for a considerable distance; the clear blue current of the Rhone passing on the western bank, and the limpid stream of the Arve on the eastern. Sometimes the waters of the Arve are so much increased by sudden thaws, as to force back the Rhone into the Lake of Geneva. The waters from the lakes of Annecy and Bourget flow into the Rhone.

As the rivers in Savoy are subject to vast and sudden inundations, from the thawing of the snow on the mountains, they bring down, at such times, an immense quantity of stones, and spread them over the bottoms of the valleys. Many a stream, which appears in ordinary times inconsiderable, has a stoney bed of half a mile in breadth, in various parts of its course;

thus a portion of the finest land is rendered useless. The cultivated slopes at the base of the mountains are subject to be buried under eboulements*, when the rocks above

* There are a few words used by the natives of the Alps, or by geologists, to denote certain forms or accidents of mountains, which are very expressive; but they cannot be translated without circumlocution, or the substitution of English words which do not convey the same idea. A previous explanation of such words may be useful.

Aguille, or *Dent*, Fr.; and German, *Horn*, are synonimous; they denote a sharp and lofty pinnacle of rock, throughout Savoy and Switzerland.

Col, Fr., literally signifies the neck, but is used in Savoy and Piedmont to denote a depression in a mountainous range or ridge, considerably lower than the other parts. It is over these cols that the roads pass from one alpine valley to another, as the Col de Balme, the Col de Ferret, &c.

Eboulement, Fr., denotes a falling down of a mountain or mass of rock, and consequent covering the lower grounds with its fragments; when an immense quantity of stones are suddenly brought down from the mountains by the breaking or thawing of a glacier, it is also called an eboulement.

Escarpment of a mountain denotes the steepest side or declivity. Almost every mountain, or mountain-range, rises more gradually on one side than the other; the side opposite to the escarpment is called the back of the mountain. Matlock High Tor, in Derbyshire, presents a good illustration of a mountain with an escarpment nearly perpendicular; it faces the river Derwent. Some of the summits of the calcareous mountains in

fall down, and sometimes cover many square miles with their ruins.

The roads, with the exception of three or four of the principal ones, are narrow and rough: some considerable valleys and ex-

---

Savoy have perpendicular escarpments on every side; they resemble castles placed upon a hill.

Gorge, Fr. literally the throat, denotes a narrow strait or passage in a valley, where the rocks on each side approach near to each other.

The highest part of mountain ranges, from whence the descent on each side begins, has no appropriate term to designate it, either in our own or the French language. By the Romans it was called *juga montium*. The word ridge, the top of a furrow, or rig, the top of a roof, might be sufficiently expressive, were they not appropriated to diminutive objects.

At the bottom of most valleys there is a flat, or plain, more or less broad; this the Germans call the *Thalweg*, or valley-way. Some valleys in the Alps have no plain; but the hills on each side slope down to the river which traverses them. We have no word to denote the thal-weg, but use the bottom of the valley to designate the lowest part of every kind of valley.

Thal, in the Swiss Alps, as well as in Germany, designates a valley, but is always written after the name, as Simmen-thal, or the valley of the Simmen, &c. In Auvergne the summits of the volcanic mountains are called *Puys*; they are generally dome-shaped, or conical. The word is probably Celtic. The rough and broken currents of lava that rise above the surface of the country are called *cheres*, probably a contraction of sierras.

tensive districts can only be entered by a mule-road. The great road from Lyons to Chambery enters Savoy at Pont de Beauvoisin, and proceeds by the Gallery of les Echelles, which may justly be regarded as one of the greatest works of Napoleon: it is described, chap. 5. This road is joined by the road from Geneva at Chambery, and is continued over Mount Cenis. The Semplon road is continued along the northern side of Savoy by the Lake of Geneva. A new road is forming from Annecy to l'Hospital on the Isere, by which the distance from Geneva to Mont Cenis will be considerably shortened. From Geneva there is a good carriage road to Bonneville and Sallenches. These roads may all be safely travelled in an English carriage, except that to l'Hopital, which is not yet finished. The other roads in Savoy are mostly narrow and rough, and can only be passed with horses or mules, or in small cars. The inns, except on the great roads, are wretched. To the state of the roads and the inns it is, perhaps, principally owing, that Savoy, a country abounding in objects of great interest, and rich in magnificent scenery beyond any

other part of Europe, has hitherto been so little explored by the English, who content themselves with following each other to Chamouny, or pass along the great road to Italy with all possible expedition.

CHAPTER I.

GENEVA TO ANNECY. — CHATEAU DUING. — LAKE OF ANNECY.

HAVING made a tour over the Semplon into Piedmont, we returned to Geneva the 24th of October, 1820, where we passed the winter; and on the 15th of May, 1821, we left that city to spend the summer in Savoy. We first proposed to remain some weeks at Chateau Duing, an ancient mansion on the lake of Annecy, to examine the country in the vicinity. The road crosses the river Arve about one mile south of Geneva, over a handsome stone bridge, erected by the French. After passing through the town of Carouge, formerly in Savoy, but now belonging to the republic of Geneva, we began to ascend gradually by the side of the Great Saleve, a mountain that ranges on the left for about nine miles, presenting a nearly perpendicular face of stratified limestone, rising from 2500 to 3000 feet

above the valley or basin in which the lake of Geneva is situated.

About seven miles from Geneva, and immediately under the highest part of the Saleve, called the Piton, we passed the ancient monastery of Pommiers, founded in 1179. The surrounding grounds are beautiful, but the situation is extremely solitary. The monks of Pommiers were the first cultivators of this once savage country, which was one vast forest, extending along the foot of the Saleve to the extremity of Mount Sion, a mountain range that branches off from it nearly at right angles, and connects the Saleve with the Vuaches and the chain of the Jura on the other side of the valley. The monks also formed the present road from Annecy to Geneva, which before passed on the other side of the great and little Saleve, by a very steep and dangerous ascent from Cruseilles, and then descended by Morney and Etrembieres. The encouragement which the monks of Pommiers gave to agriculture and some of the useful arts, and the generous hospitality they exercised to travellers, procured for them the respect and protection of their powerful neighbours. Even

the Bernese, after the reformation, when they conquered this part of Savoy, and destroyed all the other religious houses, were so convinced of the utility of this establishment, that they suffered it to remain, after exacting from the monks some contributions and the oaths of fidelity and allegiance. The monastery was broken up, and the bell and clock removed to Carouge, in the year 1793. The buildings and domain have since been purchased by an individual who resides there, and who has spoilt the old chapel by attempting to whitewash and beautify it. A visit to Pommiers forms a favourite excursion of the Genevese. Behind the monastery there is a deep ravine, along which is a zig-zag path that conducts to the Piton, the highest part of the Saleve, from whence the prospect is uncommonly grand and extensive.

Soon after passing Pommiers we came to the village of Chable, first founded by the monks of Pommiers, where our passports were examined at the Douane, as we were now in the territory of the king of Sardinia. The Genevese and Savoyards are in general very strictly examined here, but on declaring the object of our journey,

the officers merely looked into the carriage, and suffered us to proceed without further molestation.

It was three hours after leaving Geneva before we reached the highest part of the road on Mount Sion, though the distance is not more than twelve miles, and we had two stout horses to our coupé, or chariot. The elevation we had attained was about 1500 feet. It is highly probable that this mountain once formed part of the western barrier, when the whole valley was a lake, and that the waters flowed over it, before the passage called l'Ecluse, through which the Rhône escapes, was opened. Enormous blocks of granite are scattered over the summit of Mount Sion, though no rock of a similar kind is known to occur *in situ* within the distance of fifty miles.*

After passing the ridge of Mount Sion, we lost sight of the vale of Geneva, and the lofty mountains near the lake of Annecy opened on our view. They were partly clothed with snow, and their fantastic turrets were intermixed with the clouds, which, as they moved along, pre-

* Some observations on the blocks of granite scattered over the calcareous mountains of Savoy will be found in another part of this work.

sented them under such a variety of forms, that we were frequently in doubt whether what we saw before us were the mountains we had lately observed, or others which a new turn in the road had discovered. For more than an hour the scene might be called an Alpine phantasmagoria, where all the great masses seemed moving: the difficulty of distinguishing the snow from the white clouds contributed greatly to heighten the illusion. But even when the clouds were all removed, one of these lofty turretted summits, the Dent D'Alencon, appeared to change its form in so remarkable a manner, as seen more or less in profile, that we were often left uncertain respecting its identity. The bottom of the valley on our right was so covered with white stones that at a distance it appeared full of water. Not far from Cruseilles the limestone rocks on the left, close to the road, were nearly white. They were shattered into an infinitude of small pieces, like the chalk rocks in some parts of Kent, but the fragments were as indurated as the hardest marble.

We arrived at Cruseilles about twelve o'clock. The church is placed on a de-

tached rock, and forms a picturesque object on approaching the town. In former times this small town was the scene of many contests, being situated in a pass which commands the entry from Geneva into the western part of Savoy. It was necessary to rest our horses after the heavy ascent up Mount Sion, and as we did not expect to arrive at Chateau Duing in time for dinner, we determined to take some refreshment ourselves. We had here a specimen of the accommodations that may be expected in a country inn in Savoy. The bill of fare was not unpromising. Soup, boiled beef, fried potatoes, roast veal, and asparagus, a desert of cheese, cakes and apples, with wine and coffée; for all which the charge for two persons was only three franks eight sous, or two shillings and ten pence, English. This sounds very well, but in reality a more tantalizing repast could scarcelybe imagined. The soup was little more than hot water, with slices of bread and lumps of butter floating at top. The boiled beef a miserable morsel, concocted to stringy fibres. The fried potatoes were not amiss, but the veal was a small plate of very inferior meat. The asparagus consisted of eight heads of that vegetable, ranged in

due order. The wine, coffee, and desert did not dishonour the other parts of the repast, which was served up in a dirty bed-chamber.

From Cruseilles the descent to Annecy is rapid, the road making repeated zig-zags and windings, like those on the Semplon. Several bridges are thrown over the ravines, to shorten and facilitate the descent. One of these, called the Pont de la Caille, is higher and much longer than Highgate archway, which it resembles. It is so narrow and so slightly built, that it seemed unable to resist the force of the mountain torrents or falling stones, to which it is frequently exposed: it had been recently much injured, and we found it impassable; this obliged us to make a circuitous detour along the ravine before we could regain the main road. These valleys and ravines were beautifully wooded, and exhibited a great variety of striking and picturesque landscapes.

In about two hours and a half after leaving Cruseilles, we descended into a fertile plain, and soon entered the city of Annecy, situated at the northern extremity of the lake. The architecture throughout

Savoy is in bad taste, and that of Annecy is perhaps the worst of all. The houses are high and the streets narrow, with ranges of extremely low heavy arcades on each side, which exclude the light from the ground floors and shops, and by confining the air, must be very unpleasant and unhealthy. The women were sitting at their doors, knitting and spinning, and most of them looked pale and sickly; their appearance was not improved by the muslin caps with very deep borders, worn by the females in this part of Savoy. They dispense with the use of stockings in summer. Annecy is the second city in Savoy; it contains about six thousand inhabitants. There are some considerable manufactures here, particularly of cotton. Before the revolution, there were seventeen churches and monasteries at Annecy, and it was filled with ecclesiastics and religious orders. At present only three of the churches are used for public worship; the others are converted into brewhouses, warehouses, and stables. A large ancient castle, formerly the residence of the Dukes de Genevois Nemours, commands the city, and gives to it, at a distance, a very imposing appearance.

Annecy will long be remembered as the

place where Rousseau, a young fugitive, was first thrown on the protection of Madame de Warens, and where he describes having passed the most innocent and happy years of his life. On a second visit I endeavoured to discover the house where he resided, but in vain. St. Francis de Sales and La Mere Chantal, with their relics, are more known and esteemed by the good people of Annecy, than Rousseau or Madame de Warens. Perhaps the different circumstances of their lives, far more than any natural difference of disposition led to the dissimilar fate and reputation of these personages. It would not, at least, be very difficult to trace some leading features of resemblance between the characters of the saint and the philosopher. The tender friendship that long subsisted between St. Francis de Sales and La Mere Chantal, has given to their memory and relics, with pious catholics, a degree of interest similar to that excited by the remains of Abelard and Heloise.

St. Francis de Sales was descended from the noble family of de Sales, in Savoy; he was born in 1567. Having devoted himself to the church and evinced great

zeal and eloquence in its defence, he was ordained Prince and Bishop of Geneva by Pope Clement the Eighth; for the popes assumed the right to confer these titles, long after the reformed religion had been established at Geneva*; Annecy being made the bishop's seat when the Genevese expelled the chapter from their city. St. Francis de Sales died at Lyons in 1622, and was buried at Annecy. His canonization took place in 1665; but before that event, his remains were so highly valued by the inhabitants, that when this city was taken by the French in 1630, one of the six articles of capitulation stipulated, "that the body of the venerable Francis de Sales should never be removed from the city." In the year 1806, his bones were translated with great solemnity from the church where they were first deposited, to a chapel in the cathedral, and are much resorted to by devotees.

Never having seen the genuine relics of a

* At present the archbishop of Chambery stiles himself also bishop of Geneva in his proclamations. The bishops of Geneva, before the reformation, had sovereign power, and were princes of the empire; their temporal power was, however, shared with the counts of Geneva, which was the source of constant disputes that finally terminated in the independence of the citizens.

saint, we made application at the cathedral to be admitted to the beatific vision. The service was just over, and we were ushered into an apartment where the holy things belonging to the priesthood are deposited. Here one of the priests was upon his knees performing his secret devotions. When he rose and was informed what we were come for, he immediately put on a peculiar dress, and taking a lighted taper walked before us to the shrine. On entering the chapel, he crossed himself, and made two profound reverences; he then advanced, and lighting two tapers, undrew a curtain which screened the body from vulgar gaze; he again repeated his genuflections and crossings, and withdrew, leaving us to gratify our curiosity undisturbed. While this ceremony was going on, we endeavoured to preserve a becoming gravity, for it would have been both ungenerous and cruel to have wounded the feelings of our reverend conductor, particularly as he seemed somewhat ashamed of having to perform such a ceremony before English heretics. The glass case that held the relics was the full length of the saint, but all that we could see, on a close inspection,

was the scarlet robe that enveloped the body, and a silver mask that covered the face. The relics of La Mere Chantal, or Saint Jane Frances Fremiot de Chantal, are deposited in a neighbouring church, and may be seen, together with the chemise of that pious lady ; but our curiosity was sufficiently satisfied.

La Mere Chantal was left the widow of a French baron at the age of twenty-eight. Soon afterwards she was so moved by the preaching of St. Francis de Sales, that she renounced her children and family, and united with him in founding the religious order of the visitation at Annecy. She also founded, with his assistance, several new convents ; in one of which she died at Moulins, in 1641. She was canonized in 1767. Her life, with her spiritual letters, are published in four volumes, octavo.

Pious catholics regard the friendship of St. Francis de Sales and La Mere Chantal, as an edifying example of mutual affection spiritualized and refined from all admixture with the infirmities that flesh is heir to ; but as they lived at a period when the animosity between religious sects had no bounds, the character and memory of St.

Francis de Sales were attacked with much bitterness by the protestants, who described his attachment to the young widow as partaking of the frailty and consequences of earthly passion. It is reported, that a demon which had taken possession of her person, was exorcised and cast out of her in the visible form of an infant. This little imp, the protestants assert, was no other than the natural offspring of her spiritual friend and guide. Had such been the fact, we may be almost assured that the secret would have been better guarded from the knowledge of heretics, than by the flimsy veil of a Romish miracle.

From the character given of him by his biographers, as well as from his writings, it appears that St. Francis de Sales possessed much ardour and warmth of imagination and feeling, united with great suavity of disposition and manners; soaring above the superstitious ceremonies and creeds which at that period engrossed the principal attention of protestants and catholics, he regarded true religion as existing only in the heart, and external forms as merely the types and shadows of what is spiritually good.

St. Francis de Sales laboured very successfully to reform the church discipline in his diocese, and his labours were not lost; for if the curés of Savoy preserve more primitive simplicity, and have more real concern for the welfare of their flocks, than are to be found among the priests of other catholic countries, I am inclined to believe it may be principally attributed to the example and influence of St. Francis de Sales.

He was also an ardent patron of literature, and jointly with his friend Antonine Favre, established at Annecy, in 1607, the first literary academy in Savoy for the belles lettres and philosophy, called l'Academie Florimontane.

In 1549 Eustatius Chapuis founded a college at Annecy, which was at one time the most flourishing college in Savoy. It was here that Rosseau was placed to be qualified for the priesthood, but he informs us that he was found incompetent, and was dismissed.

The first public library in Savoy was established at Annecy, in 1747, by a canon of the cathedral, Nicholas Dumase, who enriched it by the bequest of his own

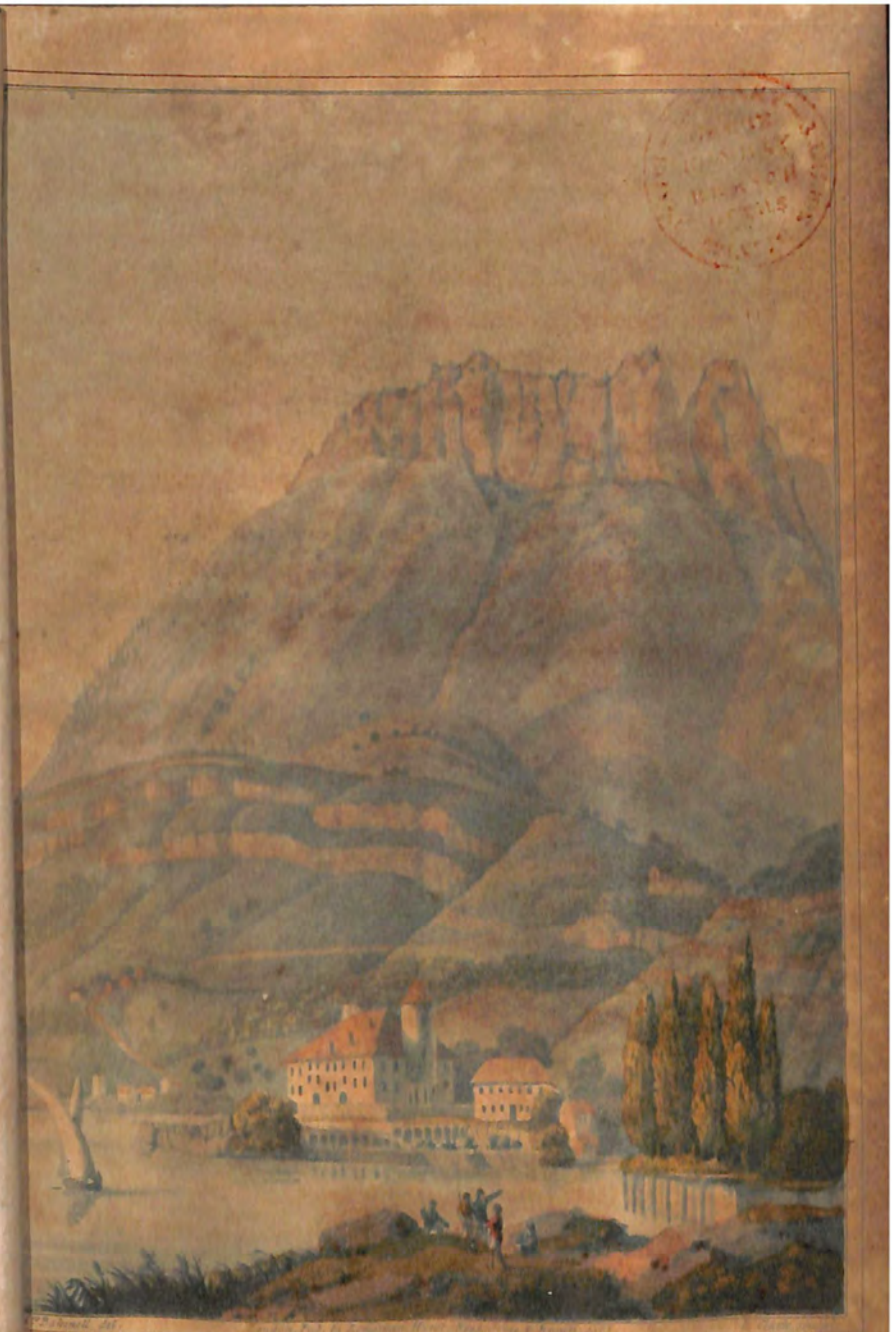
collection of books. The library has since been augmented by other similar donations.

The northern end of the lake of Annecy is the least interesting, terminating in a flat plain or marsh. There are two short channels, called Thioux, by which the lake discharges itself into the river Sier; this river falls into the Rhone at Seissel. These channels have been formed or deepened by art.

Our road to Chateau Duing passed along the western side of the lake; it is the main road from Annecy to L'Hôpital, in the valley of Isere. A mountain of moderate elevation ranges along like a wall, for several miles, not far from the side of the road, and by its straight unvaried outline, gives too much formality to the scenery. After a drive of nearly two hours, we discovered the chateau placed on a promontory or island, with the Dent D'Alençon towering up behind it. At first we were rather disappointed, as the lake appeared to terminate here, and seemed smaller and less varied than we had expected; but we soon found, on entering the chateau, that the most beautiful part of the lake, and the magnificent amphitheatre of

mountains that surround its upper end, had been hitherto entirely concealed from our view, by a high projecting range of rocks, and by the island on which the Chateau is built.

Chateau Duing, called in the records of Savoy Chateau Vieux, takes its name from the little village of Duing, on the banks of the lake below it. Its exterior is far from picturesque, being a long plain building, not unlike an English worsted or cotton factory, but at one end there is a round massive tower, of great antiquity. The island is connected with the main land by a narrow causeway, where formerly was a draw-bridge. The chateau is situated on an eminence, and is surrounded by several terraces, ornamented with flowering shrubs and green-house plants, and reminded us of Isla Madra, on Laggo Majore, which it somewhat resembles. Below the terraces is a large kitchen garden and orchard, with a trellis-walk, covered with vines, which leads to the boat-house. Monsieur Berthet, the present proprietor, purchased the chateau, and a considerable estate belonging to it, when it was sold as national property, after Savoy became a



Chateau Duing, and the Dent d'Oche, on the Lake of Geneva

part of the French Republic. It formerly belonged to the Marquis de Sales. Monsieur B. is a Savoyard, and occupies himself with the cultivation of his land. During the Revolution he was elected a deputy to the legislative assembly. Madame Berthet is a Genevese and a protestant. Having but little society and a large mansion, they were glad to receive some Genevese friends as boarders during the summer months. A Scotch family who passed a short time there the preceding summer, having found the residence agreeable, an English gentleman of our acquaintance with his wife went there the beginning of May, and through their introduction we were also admitted as boarders.

Our arrival was expected, and we met with a courteous reception. As Chateau Duing, when more known, may probably become a favourite summer retreat for the English, it may be useful to give some account of the place and the style of living. The family consisted of Monsieur and Madame B., her two sisters and a niece, Miss S., a very elegant young lady, who looks like the presiding divinity of the place, possessing uncommon beauty and

grace, with much good sense and freedom from affectation. At Geneva, where she generally passes part of the winter among her friends, she is distinguished as *La belle Savoyarde.* Besides the family there were several Genevese ladies, and seven or eight English ladies and gentlemen, who arrived a fortnight before us. The interior of the chateau was much superior to its outward appearance; a wide flight of stone stairs leads to a corridor one hundred feet in length, with apartments on each side; the second story is the same. The rooms are lofty and spacious; and the two saloons preserve the marks of their former splendour.

At eight o'clock in the morning the bell summoned the party to a breakfast of tea, coffee, eggs, and cold meat, in the English style. We dined at two o'clock, which was a convenient hour, as we were able to repose during the hottest part of the day, and had sufficient time in the afternoon for excursions on the lake or its banks. The dinner generally consisted of soup, fish from the lake, poultry, beef, and veal, with vegetables and a desert. The wine was from Mons. B.'s vineyard; but this part of Savoy is not celebrated for its vintage. At eight

o'clock we again assembled round the table for the goûté, or evening repast. It consisted of tea, coffee, and wine, with cakes, fruit, cold meat, and eggs. After this the company returned to the saloon, where the evening was passed with music, cards, and chess.

Between breakfast and dinner the company divided into parties; some were rowing or sailing on the lake, or visiting the objects of curiosity in its neighbourhood, while others were engaged with their studies or sketch-books. I frequently employed myself among the rocks with my hammer, or walked with Mons. B. over his farm, making enquiries respecting the agriculture and state of society in Savoy.

From these subjects Mons. B. would turn with peculiar pleasure to the metaphysical speculations of Bonnet, of whose writings he had been a great admirer in early life. It was a treat to him to find any one acquainted with the ingenious theories of this amiable philosopher*; these afforded con-

* Bonnet is held in high estimation in his native place Geneva. The Genevese divines, I believe, generally prefer his *Défense de Chrétianisme* to Paley's Evidences. It cannot be denied that Paley was greatly indebted to

stant themes for discussion, when reposing under the rocks to shelter ourselves from the rays of the mid-day sun. From the speculations of Bonnet we were often led into the boundless field of enquiry respecting subjects which will ever remain beyond the present limited powers of the human mind satisfactorily to resolve. Our conversations, though harmless, frequently brought to my mind, with a secret smile, the passage in Milton, where he describes the vanquished angels as amusing themselves in a manner precisely similar, and followed by a similar result.

> Others apart sat on a hill retired —
> * * * * * *
> Of good and evil much they reason'd then;
> Fix'd fate, free will, foreknowledge absolute,
> And found no end, in wandering mazes lost.

We were generally roused from these airy meditations by the distant sound of the dinner bell in the round tower of the chateau, inviting us to a more substantial re-

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the writings of Bonnet, particularly in his' Natural Theology; but Bonnet wants the sound judgment of our English divine.

past. At dinner we found the parties assembled from their different excursions, recounting the adventures of the morning, and planning some new expedition for the evening. In this manner the days passed away delightfully, and in the morning we were awakened by the full chorus of singing birds, to see the sun rise above the mountains, gilding the northern side of the lake; whichever way the eye turned it was gratified with scenes of uncommon beauty and magnificence.

The singing-birds were chiefly the blackbird and the thrush; they filled the numerous cherry-trees near Duing. The nightingale, so common around Chamberry, is scarcely heard in this part of Savoy. Indeed it is remarkable that singing-birds of any kind should abound here as they do, for the numerous birds of prey in the surrounding mountains make great havoc with the poultry, and prevent the inhabitants from keeping pigeons.

The Lake of Annecy is about ten English miles in length, and varies in breadth from one to two miles, but the island or promontory, on which Chateau Duing stands, advances so far into the lake as

nearly to divide it into two equal parts, the distance from the boat-house to the nearest landing-place on the other side being not more than half a mile. The lowest part of the lake, between Annecy and Duing, is about seven miles in length, and ranges N.N.E. to S.S.W.; but the upper part, after passing the island, ranges due south. The lake is surrounded by steep calcareous mountains, which approach very close to it, except on the north, near Annecy, where they recede, and form an extensive plain. On the southern extremity, beyond Duing, there is a marshy flat or plain, where the land is gaining upon the lake. The water has once evidently filled up the whole of the valley, from the present borders to the feet of the mountains. On the western side also, along which the road passes from Annecy, there are several large meadows, which appear to have been gained from the lake, at no very remote period.

In shape and length the Lake of Annecy may be compared to Ulswater, but it is much broader. There is also a greater resemblance between the scenery at the south end of this lake and that of Ulswater toward Paterdale, than in any other lakes I have seen on the continent.

There is no very considerable river running into the lake. The largest is La Rivière Morte, so called, I suppose, from its broad stony bed, which is nearly dry, except in rainy seasons, when the waters unite and form a mighty torrent. It rises beyond Faverge, and enters the lake at the southern end.

There are also numerous rivulets and cascades, descending from the mountain valleys, that decline to the lake. These, when the snow is thawing in the surrounding mountains, become considerable streams.

The mountains on the eastern side present their escarpements, which are nearly perpendicular, to the lake. Those on the western side are stratified, and slope down to it at a very steep angle; their summits are nearly bare, but the feet of these mountains are covered with magnificent forest trees, intermixed with cultivated fields. The banks of the lake are richly adorned with large walnut and chesnut trees, and there are several small villages, ancient castles, and farm houses scattered round it, particularly on the western side. On the eastern side the steep escarpements, sometimes project-

ing into the lake, then receding from it, form verdant amphitheatres, in which are vineyards and cottages, that seem cut off from all access with the world, except by water.

The highest mountains are on the eastern side: the Tournetts, opposite Chateau Duing, I found, by admeasurement, to rise from 5560 to 5637 English feet above the lake, and as the lake is, according to Saussure, 1460 English feet above the level of the sea, the absolute elevation of the Tournetts is about 7000 feet, or about 1000 feet below the line of perpetual snow.* The snow, however, remains near the summit till the commencement of July, and even in

* I have stated the above as the extremes of several measurements. From the difficulty of finding a base for the Tournetts, I was obliged to take one across the lake, measuring the distance by the quadrant, as a theodolite. The quadrant had sixteen inches radius. It was cut out by a carpenter in the village, and I was obligingly assisted in its graduation by my friend, Mr. B. of the Royal Engineers. I cannot vouch for the correctness of the admeasurements, taken under such unfavourable circumstances, but I think they may be relied on as good approximations.

The residents on the lake of Annecy supposed the Tournetts to be much higher. The mountains near the lake of Annecy, according to Ebel, are seen distinctly from Neufchatel.

the month of August I saw large masses of snow on the western side of the mountain, in shaded situations.

The next most remarkable mountain here is the Dent D'Alençon ; its summit is composed of a perpendicular wall or ridge of limestone, the remains of a calcareous stratum, ranged like the turrets of an ancient castle, and standing on a detached steep and narrow slope, which is partially covered with verdure. The height of this mountain I found to be 3840 feet above the level of the lake, and the height of the perpendicular wall or ridge is from 400 to 500 feet.

The most peculiar features in the physical geography of this lake are the numerous mountain valleys that slope towards it at a very considerable angle: they may be compared to funnels truncated at their summits. From the annexed sketch, taken from above the village of Talloire, a better idea may be formed of these valleys, than by any description I could give. It is a bird's eye view, or rather a map of the upper end of the lake, and is intended to show the form of the valleys and the outlines of the mountains.

The fish which most abound in the lake, particularly in the upper part of it, are trout, carp, pike and lotte. * — Lotte were not found in this lake till the year 1770, when a Savoyard gentleman having brought some from Geneva to put into his reservoir near Annecy, they escaped during an inundation into the lake, where they increased so fast as to stock it with this excellent fish, which somewhat resembles the eel in flavour, but is more delicate.

This accident may afford a useful hint for the importation of some of the most esteemed fresh-water fish of the continent into our own lakes and rivers, where there can be little doubt but that they would thrive and multiply. It is remarkable, that though none of our fruit-trees, culinary vegetables, or domestic poultry are indigenous to this country, but have

* *La Lotte commune de Rivière* (*Gadus Lota*). Cuvier classes it with the genus *Gadus*, or cod-fish, but it is the only fresh-water fish of that genus. "Longue d'un ou deux pieds; jaune marbrée de brun; sa tête un peu deprimée, et son corps presque cylindrique lui donne un aspect particulier. On estime fort sa chair & surtout son foie, qui est singulierement volumineux."

Cuvier, Regne Animal, vol. ii. p. 215.

been brought from the continents of Europe or Asia, (with the exception of the potatoe from America,) yet no attempt has been made, that I know of, to increase the variety of our fresh-water fish, by importing them from foreign countries.

CHAPTER II.

ANCIENT CASTLES ROUND THE LAKE OF ANNECY. — CHATEAU MENTHON, THE BIRTH-PLACE OF ST. BERNARD. — VALLEY OF THONES. — PEASANTRY OF SAVOY, AND RELIGIOUS PROCESSIONS.

NUMEROUS castles, more or less in ruins, are seen on the eminences that command the road on each side of the Lake of Annecy, or in the embouchures of the valleys that open towards it. Their date and early history are lost in the obscurity of the barbarous ages that succeeded the downfall of the Roman empire in the west. Chateau Duing, where we resided, is a building of comparatively modern date, except the tower on the south end, which formed part of the ancient castle. The walls of this tower are immensely thick, and seem able to resist the ravages of time for several thousand years to come. There are historic traces of Chateau Duing as far back as the ninth century. It defended the

passage from the upper to the lower part of the lake, on the western side, in conjunction with another castle or fort, situated on an eminence on the opposite side of the road. This is now nearly demolished, except an hexagonal tower in the same style of architecture as Coningsberg Castle in Yorkshire. The eminence on which it stands is flat at the summit, and is cultivated as a vineyard or garden.

About a mile from Chateau Duing, at the entrance of one of the mountain valleys, is a large ancient castle with four round towers and out-works, which also belongs to Mr. Berthet; it is called Chateau D'Herie, and is close to a small village of the same name. This resembles some of our Norman baronial castles; the gates, portcullis, and walls are entire: there are port holes for arquebuses near the gates, apparently of a later date: the windows have never been glazed. Nothing is known of the history of this castle; some of the furniture still remains. In the great hall there are benches for the dining tables, which are divided into separate seats, with carved backs and elbows, like the pre-

bend's stalls in our cathedrals. On the other side of the lake, immediately opposite Chateau Duing, is situated the large village or bourg of Talloires, containing upwards of 1000 inhabitants. North of the village, and on the banks of the lake, are the remains of a large Benedictine priory, founded about the ninth century. It was sold and partly demolished when Savoy became a department of France.

Talloires is placed in a kind of amphitheatre formed by the rocks, which here recede about a mile from the border of the lake. The ground which slopes down from the village to the water is covered with vines, and the higher ground between Talloires and the rocks is divided into corn fields richly intermingled with wood. On one of the rocks above the village are the remains of a chapel and hermitage, formerly appertaining to the priory, and to which there are still religious processions from Talloires on certain festivals. The ascent up to the chapel along a winding road cut out of the rock is extremely beautiful, and reminded me of the scenery round Matlock. There is a fine waterfall

in a ravine to the right of the road, just below the hermitage, where we were glad to repose after our long walk.

The Benedictine Priory is built in the usual bad style of Savoyard architecture. There is nothing venerable or imposing in its appearance; it bears no resemblance to the ruins of our English abbeys. The side next the lake is partly concealed from view by a deep grove of walnut and chesnut-trees.

This priory, when first founded, was celebrated for the regularity and sanctity of the monks, who supplied the Romish calendar with several doughty or doubtful saints; such as St. Germain, who flourished in 967, St. Kulp in 1018, and St. Jorex in 1107. Notwithstanding these venerable examples, the discipline of this priory in later times became very relaxed, like that of other monasteries; but on the establishment of the Reformation at Bern and Geneva, the catholic ecclesiastics in Savoy were aroused from their epicurean lethargy to contemplate the dangers by which they were menaced, when like "the little fat round oily man of God," in the Castle of Indolence,

"They sunk into their pew,
"And straight did recollect their piety anew."*

A large mansion, formerly belonging to the family of Bertholet, is the most conspicuous building in Talloires, as seen from Château Duing. It was here that the justly celebrated chemist Bertholet was born and passed the early years of his life. There is a peculiar appearance of seclusion united with cheerfulness in the situation of Talloires, and

* A reformation somewhat analogous may have been observed of late years in our own country, and those who lament the spread of methodism, would do well to comfort themselves with the reflection, that the race of Parsons Trulliber and Barnabas described by Fielding, and so common in the last century, has nearly disappeared from the land; and even the sporting divines of Mr. Crabbe,

"Those jovial youths, who think their Sunday's task,
"As much as God or man can fairly ask,"

are less frequently met with in society than formerly. Can any one doubt that the established church has gained more real strength by the increased respectability of the country clergy, than it has lost by the secession of a part of its nominal members, many of whom may be more properly styled seceders from the alehouse, than dissenters from the church? In saying this, I mean no disrespect to the methodists; it is highly to the credit of that sect that they have been eminently successful in reforming the lower classes in many parts of England, where the instruction of the poor had been greatly neglected.

often, when observing it, I have indulged myself in speculating how far the happiness of the chemical philosopher had been increased or lessened, by exchanging his native retirement for the bustle, honours, and anxieties of public life. It is generally supposed, that these are a sure specific against the attacks of *ennui;* but the fate of young Bertholet, the son of the philosopher, may teach us that this is not always the case.

Mr. B. jun. was a young man of superior talents, and his friends entertained high expectations of his future success; but neither the rank to which his father had attained, his own brilliant prospects, nor the literary society and the amusements of Paris, could secure him from *ennui*, and a weariness of life, which at last became insupportable. He locked himself up in a small room, and closing all the apertures and crevices, he lighted a brasier of charcoal, and seated himself before a table, on which he had laid a second watch, with pen, ink, and paper. He then noted down with exactness the hour when the charcoal was lighted, the first sensations produced, and the progress of delirium, till the writing became con-

fused and illegible, and he was found dead upon the floor.

About two miles north of Talloires, stands Château Menthon, on an eminence which commands a fine view of both ends of the lake. We took a boat and rowed to the landing-place nearest the village of Menthon. In crossing a meadow, we passed by some ruins, said to be the remains of ancient Roman baths. There is a spring of mineral water, containing sulphur and sulphuretted hydrogen: it is used by the inhabitants for the cure of scrophulous complaints and glandular obstructions. The ascent from the village of Menthon to the castle is steep: the slopes are covered with vineyards and gardens. The castle is a lofty irregular building in the Norman style, with massive gates and portcullis; but part of the front is of a more modern date. The rooms are hung with tapestry, and the furniture is said to be coëval with the castle; but, though very antique, this must evidently be a mistake. There is nothing in the château to excite any particular interest, excepting the circumstance of its having been the birth-place of St. Bernard, one of the most extraordinary

and useful characters of the age in which he lived. He was born, June 15. 924, and was heir to the noble family of Menthon. In his earliest youth he showed a predilection for religious studies, and a strong inclination for the priesthood, which gave his parents much uneasiness, for he was their only child, and they wished to aggrandize the family, by his marriage with a young lady of Château Duing. Young Bernard not having sufficient resolution to refuse their pressing solicitations, suffered the day for the celebration of the nuptials to be fixed; but the previous evening he escaped out of a window of the castle, and fled over the Alps. His fate was for many years unknown to his disconsolate parents. At the castle they showed us the window from which he threw himself, and the rock on which he fell without being hurt; but the height is so great that he must inevitably have been dashed to pieces, unless he made use of ropes. All difficulties of this kind, however, are easily surmounted, by having recourse to a miracle, which the catholics say was wrought on the occasion. There is a portrait of the lady to whom he was to have been married still in the castle;

and if it be a faithful resemblance, we must give the young saint credit for possessing more self-denial and courage in running away from her, than is to be found among the young men of the present age. As the picture of the lady and also one of the saints are in oils, they must be of a much later date than the 10th century. There is, however, a portrait of St. Bernard painted in distemper, with but little shading, which appears very ancient, and in which he is represented as extremely handsome, with an expression of great dignity and benevolence. Other portraits, which I have seen of the saint elsewhere, preserve a resemblance to this, and have probably been copied from it.

After crossing the Alps, St. Bernard arrived at Aoste, and received ordination, and afterwards became archdeacon of the cathedral. Possessing the zeal of an apostle, he could not rest satisfied with the easy duties of his office, but burned with impatience to destroy the worship of the heathen deities, for they were still adored in some of the sequestered valleys of the Pennine and Grecian Alps. He employed himself for forty-two years in

preaching to the inhabitants of these regions, and succeeded in overturning the statue of Jupiter on Mont Jou (Mons Jovis), now the Great St. Bernard. At that time also, there was a column (Colona Jou) dedicated to Jupiter, near the summit of that part of the Grecian Alps, at present called the Little St. Bernard. During his long residence in these savage parts, he was deeply affected by the numerous melancholy catastrophes he witnessed of travellers being lost and buried in the snow; and after he had destroyed the remains of heathen superstition, he laid the foundation of the two Hospices, which still bear his name, on the Great and Little St. Bernard, to serve as resting-places for travellers, who crossed the higher Alps into Italy. The good sense and humanity he evinced in forming these establishments, will ever entitle him to rank high among the benefactors of mankind.

In the chapel at Menthon there is, on the altar, a small statue of St. Bernard, holding several monsters enchained; and one of the domestics told us they were giants whom St. Bernard had vanquished in the Alps. The group was doubtless in-

tended to represent the triumph of the saint over the heathen deities.

It may perhaps appear strange, that the worship of Jupiter should have been continued in the very centre of Europe, so long after he had been rudely expelled from the Roman capitol, and driven from Mount Ida and Olympus: our surprise, however, may be lessened, by observing how slowly any great change is effected in the language, manners, or superstitions of the inhabitants of mountainous districts. For a proof of this, we need not go out of our own island, but may take Wales, or the Highlands of Scotland, as examples. Indeed certain Pagan rites are not yet entirely abolished in the wilder parts of England, nor was the change from Popery to Protestantism so sudden and universal as may be generally supposed. In one of the retired villages of Cumberland, it is stated, that the clergyman continued to perform mass in the church forty years after the religion of the land had been changed, having never heard of the conversion of the nation to the Protestant faith by act of parliament.

At the period in which St. Bernard

lived, the only Christians who penetrated into the retired valleys of the Alps came in troops clad in steel, to cut the throats of other Christians, headed by barons or armed bishops, who met them for the same kind purpose; and both parties plundered, ravished, or murdered the poor Pagans who lay in their route. Such practices were not well suited to recommend the religion of the cross: debased as it then was, it seemed to possess but little advantage over heathenism. But St. Bernard was a Christian of a very different kind. He considered his religion as something better than "a cunningly devised fable," and that it was intended for nobler purposes than to fill the coffers of the clergy. He was, perhaps, the first true Christian the Pagans of the Alps had ever seen. His enthusiasm and perseverance, tempered with benevolence and good sense, produced the effects of the fabled lyre of Orpheus in humanizing the savages of the desert.

St. Bernard was not so successful in combating the degeneracy and corrupt morals of the higher orders of the priesthood, which he discovered with not less surprise

than grief when he visited Rome. Against this degeneracy he long remonstrated, and continued to remonstrate, in his letters to the Pope, who appears to have received his advice with much good nature, always courteously thanking him for it; assuring him that he would set about the reformation of the clergy whenever the pressure of weightier matters would permit. St. Bernard died in 1008, aged 85. Tradition relates, that his parents, after having bewailed the unknown fate of their son for twenty-six years, discovered him at the newly erected hospice on the Great St. Bernard.

Besides the castles already described, there are the remains of an old tower, and also of an ancient fort or castle at the southern end of the lake; and about three miles from the lake, on a considerable eminence stands Château Giez, the summer-residence of the Marquis de Villette. There is nothing striking in the château; it is merely an ancient building with four round towers; but the surrounding grounds are in the highest style of wild natural beauty, richly adorned with the most luxuriant walnut and chesnut trees, inter-

mixed with various other forest trees. From the hill, a little beyond the château, there is a particularly fine view of Mont Blanc, seen through an opening in the nearer mountains. We came with a party from Château Duing to spend the day here, and dined in the grounds, having brought cold provisions with us. From hence we visited Faverge, a considerable town two miles from the end of the lake. In the twelfth century it was called *Fabriciæ* and *Fabricarum*, from the great number of manufactories established here, particularly copper and iron forges. These are supposed to be as old as the time of the Romans, various coins and antiquities having been found in the neighbourhood. It has been conjectured that Faverge is the ancient Casuaria mentioned in the Itinerary of Antoninus, and that it is from hence that Plancus wrote to Cicero. Faverge at present contains about 2000 inhabitants. The ancient château, built on an eminence, formerly belonged to the dukes of Savoy; but it is now a considerable silk manufactory. We ascended to the castle more to enjoy the prospect than to see the manufactory.

From Faverge and the neighbouring valleys the produce is brought down to the lake and carried in large flat-bottomed boats to the market at Annecy, twice a week. On the lake of Annecy oars are generally used instead of sails, excepting in very calm weather, the navigation being dangerous for sails on account of the sudden gusts of wind which drive down from the mountain-valleys that open on the lake.

Between Faverge and Duing a new and excellent road is forming, by order of the Sardinian government. It is carried along close to the borders of the lake, and is therefore more level than the old road, which is higher up at the feet of the mountains, but nearly parallel to the new road, and at no great distance from it. It is intended to continue this new road as far as L'Hôpital, and thus to shorten the route from Mount Cenis to Annecy and to Geneva.

We had here an opportunity of witnessing the oppressions of the *corvée*, or levy, by which all proprietors, or even peasants, who have one or more horses, mules, or oxen, are obliged to bring them, and work themselves also at the road, three or

four days in every week, for two months, without any wages or recompence whatever. In case of failure, their goods are seized, or soldiers are quartered on them in proportion to the extent of their defalcation. The misery and dissatisfaction expressed in the famished countenances of these poor labourers, whom we frequently met returning of an evening, I shall never forget. Great numbers of them came from a distance, and nearly one-third of those who worked on the road were women, who helped their husbands or sons.

One day we passed the cottage of a widow, who appeared in great distress; on enquiring the cause, she told us that her only son had absconded to avoid working at the corvée, and she was every moment expecting the officers to come and take away the little furniture she possessed. Such are the blessings of the legitimate and paternal governments which the allied powers bestowed on Savoy and the Italian states, in 1814, when they replaced them under the dominion of their ancient rulers, without any regard to the feelings, the wants, or the wishes of the inhabitants, and then, as if in mockery, they styled them-

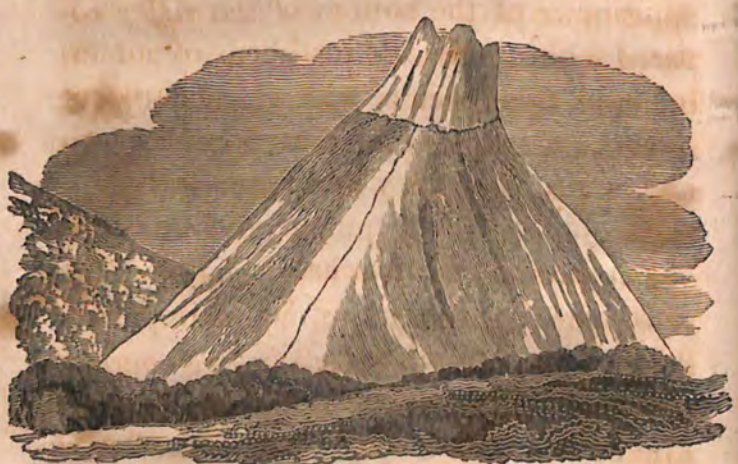
selves the liberators of Europe. With as much truth might the emperors of Fez and Morocco be styled the liberators of Africa.

Behind the mountains that overhang the eastern border of the lake of Annecy, there is a large secluded valley, rarely if ever visited by tourists. It is called the Valley of Thônes. Like the happy valley of Rasselas, it seems cut off by nature from all intercourse with the rest of the world, being surrounded on every side by steep mountains; and there is no natural opening, except a deep chasm or gorge at the lower part, through which the water issues, but which was too narrow to allow of a pathway, till it was widened by the labour of man. There are other secluded valleys in Savoy, which are well cultivated and comparatively populous, and into which a passage or opening has been made, by carrying a road over the mountains, or by widening a natural gorge.

I was extremely desirous of examining the rocks in the valley of Thônes, having seen their remarkable summits at a distance; and as the horses were all employed in the harvest or in the corvée, I was obliged to content myself with a large ass,

which was hired from a peasant in another district.

With dapple, and an attendant on foot, I crossed the lake to Talloires, and proceeded to Château Menthon, from whence the road ascended eastward round the flank of the Dent D'Alençon. This singular mountain had now entirely changed its appearance; for instead of the castellated summit, represented in Plate II., as seen from Duing, it resembled a vast broken column placed on an immense cone, as in the annexed cut.



The ridge or wall of limestone which covers the summit of the mountain being extremely narrow, its breadth, when thus

seen in profile, scarcely appears to exceed its height. It was this change of form that had surprised me so much on the road from Cruseilles. The cause was now explained.

After ascending to a considerable height, I began to discover the valley of Thônes below me, and could trace the course of the river as far as the gorge or chasm through which it flows out, at the end nearest Annecy. The opening scarcely seemed wide enough to permit the river to pass in rainy seasons, or when it is enlarged by the melting of the snow in the mountains. The appearance of the bottom of the valley covered with osiers and broad beds of stones, indicates the difficulty with which the water sometimes escapes even at present, and also proves that the valley had formerly been a lake.

The Romans first opened a road into the valley through this gorge, by cutting away the rock, and by building a bridge over the torrent. The bridge remained to the year 1794. The name of the Roman General who first opened the passage is still to be seen cut in the rock. L. TINCIUS PACULUS PER VIUM FECIT. It is now called the passage

of Saint Claire. In ancient writings it is styled Clusæ Sancti Clari.

The road from Talloires descends into the valley on its western side, about four miles above the gorge. The valley spreads out in the upper part, and several lateral valleys open into it, which may be regarded as branches of the main valley. The valley is better cultivated than many of the other parts of Savoy, and the houses also appear better built and more respectable. It contains much good corn and pasture land, and they also raise a considerable quantity of flax. Though on a level with, and parallel to, the basin of the lake of Annecy, there is a great difference in the temperature of the two valleys. There are no vines raised here, but the wine is brought from Talloires.

From the narrowness of this valley, and the reflection of the sun from the rocks, it is sometimes suffocatingly hot, as I found by experience; but its mean temperature is considerably below that of Annecy, as the mountains that impend over it on the western side throw it into shade for a considerable part of the day, and they retain

the snow much longer on this side, as they face the east. This I observed to be the case; for though it was the latter end of August, there was still a considerable quantity of snow on the Tournetts, which forms part of the western side of the valley; though snow had long since disappeared on the other side of the Tournetts next the Lake of Annecy. The lower part of the Tournetts was covered with pastures and forest-trees, principally pines.

Here, as at the Lake of Annecy, the mountains on the eastern side of the valley turn their escarpements towards the west, but they are more precipitous. There is one rock which appears like an immense tower, having a perpendicular face of nearly 2000 feet, without any break whatever, before it slopes to the vale. It is the largest unbroken perpendicular mass of limestone I ever beheld. The head becomes overpowered and dizzy in looking up to it.*

* This perpendicular rock may be seen from near Cruseilles, and also in part from Collonges, on the road from Geneva to Lyons, appearing behind the Vouache. The Tournetts, called by the country people the Mountain of St. Catherine, is seen to the right of it from Collonges.

The town of Thônes is situated higher up the vale. There appears no carriage-road to it, but I was surprised to find, on entering the gate, that it was a handsome town for Savoy, containing above 2000 inhabitants, with a spacious market-place, and a well built church in the centre of it.

The persons at the inn where I alighted were surprised to see a stranger, and still more so to find that I had no other object in view but to explore the valley, at which, however, they seemed much pleased. They endeavoured to persuade me to sleep there, in order that I might visit some mountain-lakes the following morning, which they represented as highly curious. It may appear extraordinary that there should be so considerable a town in a situation apparently so secluded, but Thônes is the capital of a number of valleys which open into the main valley, and have no other outlet. Each of these valleys contain several villages and hamlets, and it would be scarcely possible for the inhabitants of these remote villages to attend the market at Annecy, in order to dispose of their produce. It is therefore brought to Thônes, and purchased by agents from different parts of Savoy, and even from Geneva.

The whole population of the valley of Thônes, including the mountain valleys that branch from it, amounts to nearly 12,000 persons. It forms a canton in Savoy. There is a glass-house, tanneries, and various manufactures at Thônes, to supply the inhabitants of the district with articles of indispensable necessity. Fairs for cattle and cheese are held here four times a year.

Though the valley appears closed in southward, there is a horse-road winding up between the mountains to Faverge, and another road on the east to Cluse, but this is more difficult. It is near this last road that the mountain lakes are situated.

Having in some degree satisfied my curiosity, respecting certain objects of geological enquiry, which induced me to visit Thônes, I left it at the approach of evening, though I should have liked to have prolonged my stay, but I had made no arrangement for the purpose when I left Duing.

The narrowness of this valley, the abrupt termination of the strata, and their present position, plainly prove that it has been formed by an agent more powerful than the erosion of water. On the eastern side of the valley, about two miles from the

town of Thônes, there is a rock which presents an appearance of double stratification, not uncommon in the calcareous mountains of the Alps, and which has frequently induced Saussure to suppose that vertical strata were placed in junction with other strata nearly horizontal; an error into which he has been led, by mistaking very distinct vertical cleavages for stratification. On approaching this rock, I had little doubt that the strata were vertical; but when I came in front of it, I perceived the true strata-seams forming curves, which were intersected at one end by a vertical cleavage, as in the annexed figure.

It sometimes happens that the strata-seams are entirely concealed in a perpendicular escarpement of rock, by a calcareous incrustation deposited over the face of the rock, and, in such instances, the cleavages often project and resemble strata so much that it requires great care to avoid error in tracing the true line of dip in the stratification. This probable cause of error is of very frequent occurrence in the Alps, and I shall again have occasion to refer to it.

The air in the valley, which had been extremely sultry and close during the day, now became cool and refreshing, and as the shades of night approached, they threw an imposing solemnity over the impending cliffs; but my enjoyment of the scenery was disturbed by an unforeseen accident. The poor donkey on which I rode became lame, his master having sent him unshod. This greatly retarded our progress; and long before we had descended the mountains, the sun had set, and it was so dark that we could with difficulty discover the road. As we were proceeding at a very slow pace, my guide's foot slipt, and he fell down a considerable descent into a vineyard; but fortunately he received no

material injury. It was nearly midnight when I crossed the lake and arrived at Chateau Duing, after a delightful but somewhat fatiguing excursion. Travellers who may be disposed to explore the valley of Thônes, should go from Annecy on horseback or on foot; and by sleeping at Thônes, they might visit the mountain-lakes and the upper part of the valley, which I am persuaded would well reward their labour.

Though the peasants in this part of Savoy are generally poor, yet the land being much divided, most of them possess a little portion of ground, sufficient to supply their families with potatoes, which is their principal food. This gives them a feeling of equality and independence among themselves, and they are very courteous to strangers. Unlike the inhabitants of Chamouny, who have been spoilt by the influx of visitors, and who are continually following you wherever you go, and begging under the specious pretence of offering fruits, flowers, or milk, the peasantry here greet you civilly as you pass, but rarely obtrude themselves further on your notice, though they are very ready to answer any enquiries you may wish to make.

The numerous little flocks, consisting of a few sheep and goats, and one or two cows, returning home in the evening, winding down among the rocks, form the most picturesque pastoral groups imaginable. The women or girls who conduct them are always busily employed, either knitting, platting straw, or spinning wool or flax with the distaff.

The distaff, the first of all spinning machines, was used, in its present form, in the remotest antiquity, and has been the only instrument employed in many countries for some thousand years; even a few years since it was used in the counties of Norfolk and Suffolk, by the country people, for spinning worsted for the manufacturers of Norwich. Its execution is susceptible of greater perfection than might have been expected from the extreme simplicity of the operation; and it has this advantage, that it may be used by the spinster in the fields. From the distaff to the cotton-mill of Arkwright, the progress of mechanical improvement appears almost immeasurable; but the distance between these two extremes is less than might be imagined on the first view. From the

distaff to the running-wheel the transition is easy, as the latter is only the distaff set in motion by a wheel. From the running-wheel to the fly-wheel, which winds up the thread as it is spun, the progress is greater; but when this was once discovered, it only required the substitution of rollers to supply the action of the fingers, and we have the principle of the most improved spinning machines. The moving power of Arkwright's first mill was a horse. Our admiration of these mechanical inventions, brought to their present state of perfection, is shaded, however, by a knowledge of the vice and misery that have been created by them in various parts of England.

Almost every article of dress worn by the peasants in Savoy is of domestic manufacture. The wool of their little flocks is dressed and spun by themselves, and wove by the village weaver. Black sheep are very general in Savoy; and by mixing the black and white wool together, a sort of greyish brown cloth is produced, which saves the expense of dying. The flax is also dressed and spun by themselves, and wove in the neighbourhood. Itinerant tailors and shoemakers make the clothes

and shoes of the peasantry under their own roofs, as was the case among the farmers in England half a century ago, when the tailor was the travelling gazette of the village, and brought to the good housewives of those days all the important histories and anecdotes that were known concerning the king and the queen upon the throne, or the vicar and the vicar's wife of the adjoining parish.

I have frequently mentioned the immense number of large walnut-trees that grow around the Lake of Annecy, and in the valleys of this part of Savoy. The walnut is the natural olive of this country, supplying the inhabitants with oil for their own consumption, and also a considerable quantity for exportation to France and Geneva. The walnut harvest at Chateau Duing commences in September: they are beaten off the trees with long poles; the green husks are taken off as soon as they begin to decay; the walnuts are then laid in a chamber to dry, where they remain till November, when the process of making the oil commences. The first operation is to crack the nuts, and take out the kernel; for this purpose several of the neighbouring pea-

sants, with their wives and elder children, assembled at the chateau of an evening, after their work was done. The party generally consisted of about thirty persons, who were placed around a long table in the kitchen; one man sat at each end of the table, with a small mallet to crack the nuts by hitting them on the point: as fast as they are cracked they are distributed to the other persons around the table, who take the kernels out of the shell, and remove the inner part; but they are not peeled. The peasants of Savoy are naturally lively and loquacious; and they enliven their labour with facetious stories, jokes, and noisy mirth. About ten o'clock the table is cleared to make room for the gouté, or supper, consisting of dried fruit, vegetables, and wine; and the remainder of the evening is spent in singing and dancing, which is sometimes continued till midnight. In a favourable season the number of walnuts from Mr. B.'s estate is so great, that the party assemble in this manner every evening for a fortnight, before all the walnuts are cracked; and the poor people look forward to these meetings, from year to year, as a kind of festival. They do not receive

any pay; but the gouté and the amusements of the evening are their only reward.

The kernels are laid on cloths to dry, and in about a fortnight are carried to the crushing-mill, where they are ground into a paste; this is put into cloths, and undergoes the operation of pressing, to extract the oil. The best oil, which is used for salads and cooking, is pressed cold; but an inferior oil, for lamps, is extracted by heating the paste. Thirty people, in one evening, will crack as many walnuts as will produce sixty pounds of paste; this yields about fifteen wine-quarts of oil. The walnut-shells are not lost among so frugal a people as the Savoyards, but are burned for the ashes, which are used in washing. Two pounds of these ashes are equal in strength to three of wood-ashes; but the alkali is so caustic that it frequently injures the linen. The paste, after it is pressed, is dried in cakes, called pain amer; this is eaten by children and poor people, and it is sold in the shops in Savoy and Geneva.

The best walnut oil, pressed cold, has but very little of the kernelly taste; but it may be easily distinguished from the best olive oil, which it resembles in colour. If

the peel were taken off the walnuts, the oil would probably be quite free from any peculiar flavour; but this operation would be too tedious.

During our stay at Duing, Madame Zollikoffer, the mother of Madame B., who resided in separate apartments in the chateau, died after a long illness; and as she was a protestant, her funeral afforded us an opportunity of ascertaining the degree of religious toleration now subsisting in Savoy. When Savoy was united to France, Mr. B., who is a catholic, had no difficulty in obtaining permission to part off a small portion of the church-yard for the interment of his wife's grandmother, who died at Duing about that time. It was inclosed by a low wall, which was not removed when Savoy recovered its independence; and as Mr. B. is the principal proprietor in the parish, he is still suffered to retain possession of this small cemetery for the interment of the female members of his family. It was here that Mrs. Z. was to be buried. The day before the funeral, we understood that it was to take place early the following morning; but when we assembled at breakfast, we were all sur-

prised to learn that the corpse had been interred in the middle of the night, though none of the numerous visitors in the chateau had heard the slightest noise when the coffin was removed. — Excepting the Vaudois in the valleys of Piedmont, who enjoy a very restricted toleration, protestants are not tolerated in the Sardinian dominions, and the secrecy with which the funeral was conducted at Duing, arose from the fear of unpleasant feelings being excited by the burial of a heretic within the precincts of consecrated ground.

I believe there is not a protestant place of worship in all Savoy. During the wars between the Bernese and the Dukes of Savoy at the beginning of the Reformation, the government thought it politic to expel the protestants from the Dutchy, and they have never since been tolerated; but their expulsion was conducted with more leniency and good sense than might be expected, considering the character of the age.

The district of Chablais was conquered from Savoy by the Bernese in 1536, and was converted to Calvinism partly by main force, the Bernese taking away all the bells of their churches, and prohibiting the ex-

ercise of many of the catholic rites. Fifty-eight years afterwards the Chablais was reconquered by Charles Emanuel, first Duke of Savoy; who, instead of harshly ordering the inhabitants to face about and change their creed, sent among them St. Francis de Sales and the most eloquent preachers in his dominions, by whose labours in a few years they were nearly all induced to embrace the catholic faith. Those who still adhered to the protestant religion were assembled by the Duke in the town-hall of Thonon, when he exhorted them to join the church of Rome, as he did not think it safe to tolerate any of the partizans of the canton of Bern in his dominions. He allowed them six months to consider of his proposal; after which time, if they continued in heresy, they were to quit Savoy.

This was one of the mildest persecutions of which the history of those times affords any example, and also the most politic, as it effected its object by keeping within the Dutchy a large portion of the respectable inhabitants of the Chablais, who would have fled from more severe measures.

The Savoyards are more religious than

their neighbours the French; and if a Catholic wished to show his religion under its most attractive form, he should lead us to the remote villages of Savoy. The curés, or parish priests, have a house and garden, and from seventy to a hundred Napoleons per annum, which is paid by the government out of taxes raised for the purpose, tithes having been abolished since the French Revolution. As the priests have no families, this income is sufficient to provide them with all the comforts of life. They are seldom translated or removed from one parish to another, and have no temptation to be cringing to the great, and hunting after preferment; but being once fixed in the cure, where they expect to spend the remainder of their days, they generally devote themselves to the instruction and edification of their flocks, or to visiting the sick, and offering advice and consolation to the afflicted. On many of their countenances, benevolence and simplicity of character were strongly marked; and the conversation I had with some of the Savoyard curés tended to confirm the favourable opinion I had formed of them. Their influence and authority is, however, very

great. It is necessary to obtain permission of Monsieur le Curé, before a Savoyard can have a little dance, even in his own house; and in many parts of Savoy, dancing is entirely prohibited.

The religious fêtes and processions, which are more strictly observed here than in France, form an innocent amusement and an agreeable variety to so simple a people as the Savoyards: these fêtes must also tend to civilise them and soften their manners; perhaps, there may not be much religious feeling connected with such observances, but this may be said of ceremonial worship of all kinds, in every age and country.

Between the procession of the fête Dieu, as observed at Paris and in the valleys of Savoy, there is, however, an amazing difference, greatly in favour of the latter. We had an opportunity of seeing the ceremony at Duing and Talloires in 1821, and the following year at Paris. The branches of trees and garlands of flowers that overhang or adorn the path along which the procession was to pass at Duing, seemed a more appropriate tribute of respect to the supposed presence of the Deity,

than the Gobelin tapestry at Paris, on which were wrought the loves of Mars and Venus, with battles and sieges, and scenes from the history of the French court, with figures of men in bag-wigs, and women in hoop-petticoats, in every variety of fantastic attitude. This tapestry was extended in frames on each side the road from the Tuilleries to the church of St. Germain.

At Duing, the serious and devout appearance of the people excited feelings of respect; nearly the whole of the population, consisting of about two hundred and fifty persons, assisted at the ceremony, dressed in their best holiday suits. At Paris, the gaudy appearance of the priests, weighed down beneath their mantles of cloth of gold, and headed by John the Baptist in his vestment of camels' hair, excited nothing but feelings of disgust or merriment, even among the catholics themselves; nor can it possibly be otherwise, when religion is presented as a splendid farce to a well-informed people.

But it is not from their public processions that we can judge of the religious feelings of the Savoyards. The churches here, as in other Catholic countries, are

left open for private worship. The Savoyard, before going to his labour, generally visits the church, if it be near, to offer up his orisons. Often, when I have entered one of these retired churches, either from curiosity or to rest myself after a walk, and supposed I was alone, as my eyes became accustomed to the gloom, I have discovered a peasant on his knees, absorbed in serious meditation or prayer, after which he would rise, cross himself, and retire. There may be error mixed with these devotional exercises, but they are performed with humility, unobserved by human eye, and must, at least, have the merit of sincerity. I was often tempted to say, with Burns —

> " Compar'd with this, how poor Religion's pride,
> In all the pomp of method and of art,
> When men display, to congregations wide,
> Devotion's every grace, except the heart."

The Savoyards here are well made: their features are frequently handsome and rather delicate; but owing to poverty and bad nourishment, they have a sallow complexion and famished look. As age advances with its infirmities, the poor become melancholy objects; and their future prospects in this life are truly gloomy, since the

abolition of the monasteries, where they could formerly apply for aid. I have seen old men and women staggering under burdens, who seemed paralysed in every limb, and scarcely able to drag themselves along. By a kind provision of nature, however, the number of these aged sufferers bears but a small proportion to that of the young, whom health and animal spirits make cheerful for the present, and who suffer little from anticipation of the future. The Mantuan bard was probably led into a similar train of reflection, from observing the misery of the aged peasantry on the southern side of the Alps when he most feelingly exclaimed —

" Optima quæque dies miseris mortalibus ævi
Prima fugit: subeunt morbi, tristisque senectus;
Et labor — et duræ rapit inclementia mortis." *
Georgic. lib. iii. lin. 66.

To the aged poor the church is the only asylum where they can seek hope and consolation, either from the intercession of the compassionate Virgin, or some favourite

* The happiest days of wretched mortals fly
The first away — diseases soon succeed,
And painful toil, and sorrowful old age,
And death relentless comes to close the scene.

tutelary saint; and cold-hearted must that man be, who would wish to deprive them of it.

To those persons who have only attended high mass in great cities, or in the chapels of catholic ambassadors, perhaps the following account of the Sunday's service in the village churches in the valleys of Savoy, may not prove uninteresting: indeed we found the service at Duing more rational and better adapted to the capacities of the hearers than we had expected. Though the mass, as is well known, is always performed in Latin, yet the sermon, and the exercises in the catechism, were all in the French language, and were made as intelligible and interesting as the subjects could possibly admit of. We remarked, that most of the congregation, though very poor, were able to read, and made use of French prayer-books.

The men stood near the altar, and assisted in chaunting and other parts of the service; the women sat on benches in the middle of the church. They had all an appearance of great seriousness and devotion. In the front of the gallery were a few venerable looking old men, whose fine countenances

would have made an admirable group for the pencil of Raphael. After certain prayers and chaunting, the priest delivered a sermon from the pulpit in a familiar style, suited to the capacities and circumstances of his auditors. Sometimes the service was varied by a procession before the sermon; for beside the more solemn and public processions on grand fête days, there are frequently minor processions on the Sundays, which are confined to the precincts of the church-yard. A number of persons in the congregation, of both sexes, devote themselves to assist in all the processions, and have a peculiar dress for the purpose. These dresses they bring with them to the church, tied in a bundle, and in the middle of the service they put them on, and each one takes a lighted taper; they then march out, two-and-two, singing, and are followed by the priest and congregation. After making one or more détours round the church yard, they re-enter the church, and the regular service of the day goes on. These minor processions are probably intended to give interest and variety to the worship; they must, at least, have the good effect of keeping the people awake. For this purpose,

perhaps, similar processions might sometimes be introduced with advantage, into the afternoon services of protestants of all denominations. The dresses for both men and women are long white shirts, which they put on over their clothes. The women throw a muslin handkerchief over their heads, often tastefully arranged, like the head dress of a Madona. The men put a square napkin on their heads, one corner of which hangs down to the chin, and entirely covers the face, except two small apertures which are cut for the eyes: this costume has a grotesque appearance.

One Sunday the priest explained the nature and end of the seven sacraments; his doctrines did not differ greatly from those of our national church, except on transubstantiation. Baptism, he said, was an engagement on the part of the parents to bring up their children religiously; and confirmation an engagement on the part of the children to confirm the vows of their godfathers and godmothers before receiving the communion. After the sermon, the clerk went round and distributed bread in small pieces, of which all partook. This is in imitation of the practice of breaking

of bread, which formed a part of the regular service among the primitive Christians whenever they assembled. Among the catholics, this ceremony has no connection with what is called the sacrament of the Lord's supper; though, doubtless, in its origin it was the same, before the simple rites of Christianity were involved in mystery, to increase the power of the clergy.

At the conclusion, the priest examined the children in the catechism before the congregation, walking about in the middle of the church all the time, and speaking to them in an easy familiar manner. His first question was, "What do we all desire most?" One boy answered, "God;" another, "paradise;" but the priest told them it was "le bonheur," (happiness,) that all men most desire, and that happiness was to be obtained by fulfilling the will of God; that his will was to be learned of the *priest*, as the means, and that paradise, or eternal life, was the end. To the next question, "Whether there was one God or many?" the reply was much the same as in the Nicene creed; but he endeavoured to explain the doctrine of the two natures of Christ, by our having a soul and a body.

Whether we suffer mentally or corporeally, he said, it was still the same person who suffered. He then asked a boy "what became of the soul when the body was buried; does it go back to the house '*pour arranger ses affaires*' to look after its affairs?" "No, it goes into limbo, or purgatory, (we could not distinctly hear which) to await its doom." Observing a little girl asleep, he cried out. "*Fanchette eveillez vous, vous avez toujours un grand talent, pour vous endormir tout suite.*" And another time he called to a little boy to reply to a question—"*Repondez Paul, car vous etes un petit homme de grand talent, surtout pour répondre quand il n'est pas necessaire.*" Among the means of grace, he particularly recommended making the sign of the cross, as an acknowledgment of putting themselves immediately under the protection of God. One boy being asked when he should make the sign, replied, in the morning and evening; on which the priest told him it was of equal importance at all hours: as, when he was in a passion, or tempted to commit a bad action; or when he had followed his sheep among the rocks, and was in danger of falling down a precipice, &c. In this man-

ner he also explained various moral duties. Whatever opinion we may entertain of the catholic faith and ceremonies, it cannot be denied, that this easy conversational style of communicating instruction by questions and illustrations, suited to the capacities of children, is better adapted to excite attention, and to make a lasting impression on the mind, than the method of catechising in some protestant churches, where the children are taught to repeat a series of printed answers to a series of printed questions, to which they attach little or no meaning; nor, indeed, is it expected that they should: it is sufficient, if, like parrots, they can repeat the answers by rote. The priest here, as in many districts of Savoy, is the only schoolmaster in the village, and teaches the children of the peasants to read without any remuneration.

CHAP. III.

DEPARTURE FROM CHATEAU DUING. — ANNUAL MIGRATION OF THE SAVOYARDS. — LOWER VALLEY OF THE ISERE. — L'HOPITAL. — CONFLANS. — CASTLE OF MONTMELIAN. — THERMAL WATERS OF AIX LES BAINS. — MODE OF DOUCHING. — COMPANY AT THE BATHS.

One of my principal objects in visiting Savoy was to make trial of the thermal waters of Aix les Bains; and the season being now arrived, we left Chateau Duing on June the 25th, with two young ladies, who accompanied us to Chamberry, having engaged two cars at Annecy for ourselves and the luggage. The direct road to Aix was through Annecy, but we made a considerable detour, and went by another route, in order to view the valley of the lower Isere, which is regarded as the most fertile part of Savoy. Passing along the upper end of the Lake of Annecy, we left the town of Faverge on our right, and on a turn of the road we stopped to take a parting

view of Chateau Duing, where we had all passed several happy weeks.

The road from Faverge to Ugine ascends gradually for about three miles, and after crossing a low col, or passage, in the mountains, leaves the basin of the Lake of Annecy, and enters a narrow valley, the waters of which flow in a contrary direction, and fall into the Isere. When the sky is clear, from this part of the road there is a fine view of Mont Blanc, which is seen more in profile, and about twenty miles nearer than from Geneva. As we proceeded, the mountains assumed a different character; they were no longer capped with turrets of limestone, like those round the Lake of Annecy, but presented peaked and serrated summits, and were evidently a lower formation; they were composed principally of a coarse siliceous breccia and dark schistose greywacke, dipping in a northerly direction.

Near the village of Marlens the valley is covered by an eboulement, with blocks of dark greywacke schiste, through which the road winds. At what period they fell into the valley is unknown.

The young men in these valleys emigrate into various parts of Europe to find employ-

ment, in the winter months. This migration takes place at the end of October. Mons. Grillet, a Savoyard clergyman, has given the following interesting description of the migration from the vicinity of Faverge and Marlens, which he witnessed when residing in that neighbourhood.

"An old trader from St. Ferrol, who, by the frequent journies he had made, had acquired an exact knowledge of the country he had traversed, and of the money that might be gained by migrating during the winter months, collected from the neighbouring hamlets and villages all the young people who wished to follow him. The fathers eagerly presented their children to him, praising their intelligence, health, and acquirements. The old man, like a skilful recruiter, examined attentively the shape and limbs of the boys, and interrogated them on their knowledge of business, or their capacity for service or labour, and finally he fixed the sums that he would engage to give to the respective parents, for the services of their children during the time of their absence. Boys, from eighteen to twenty years of age, were to have thirty-six francs, those from fourteen to sixteen twenty

francs, and the fathers of those who were only twelve years old, were to receive twelve francs. When the terms were agreed on, all the boys were put under the authority of this travelling merchant, and were commanded by their parents to obey and respect him, and to give him an exact account of all the money they gained. The parents also exhorted their children to practise the duties of religion, and to return to their native villages, free from reproach, in the spring.

"The person who takes the charge of the boys lets them out by the week or day, and receives their wages. When they are in large towns, like Paris, the wages go to a common fund, and a strict system of police and subordination is maintained. The necessary expences of travelling are paid out of this common fund, and after the parents have received the stipulated sums, the residue is the property of the leader or contractor."

Mons. Grillet also gives the following account of their return home.

"The return of the boys was announced to the villages by the repeated firing of pistols: the caravan, out of their moderate

gains, had bought an ornament for the parish church; they presented themselves and their offering, first to the curé, who received it with the most lively gratitude, and on the following Sunday it was displayed upon the altar, and became an object of emulation to the children who were yet too young to migrate. In this manner the churches in the mountains are supplied with ornaments and sacred vessels for their altars."

Before our arrival at Ugine, we came in front of the escarpment of a high mountain called the Charvin; the back of this mountain we had seen all the way from Faverge, sloping down to the north, at an angle of about 45°, apparently as smooth and flat as if it had been one enormous slate. It was thinly covered with vegetation and pine trees. The escarpment was a bare, precipitous, pyramidal rock, rising at least six thousand feet above the road, unvaried by any patches of cultivation or groups of forest trees. There is something appalling in the near aspect of such an immense mass of bare stone, but when seen from a distance, over richly wooded hills, from the valley of the Isere, it forms a magnificent back-ground to the picture.

Ugine, though a town of considerable traffic, does not contain one tolerable inn where travellers could dine or sleep ; but it will be absolutely necessary that inns should be established, both here and at Faverge, when the new road is completed.

After resting the horses at Ugine, we continued our route. The road descended rapidly to the river Arley, and then turning suddenly to the west, brought us under the shade of a range of mountains, that form the northern boundary of the vale. Here we alighted to dine upon the grass, our friends at Duing having kindly supplied us with provisions. The day was intensely hot, and the refreshing coolness of the shade was indescribably delightful. Never before had I felt the full force of that comparison of the Hebrew poet, where he speaks of " the shadow of a great rock in a weary land." We had a brawling rivulet at our feet ; the vale before us was rich in woodland and pastoral scenery, and resembled the most picturesque valleys in Cumberland and Westmorland, but on a grander scale.

We were now in the upper part of what is called the Great Valley of Savoy. It extends fifty miles in a south-westerly di-

rection from the western side of the mountains near Sallanches, to the frontiers of France. The river Arley runs along the upper part of the valley, and is joined in its course by the Doron from the district of Beaufort, and by the Isere from the Tarentaise. The junction with the latter river is at Conflans, where the Arley loses its name in that of the Isere, though it continues the same course as before, the Isere meeting it nearly at right angles from the south. There is a horse-road along the upper part of the valley of Arley, which passes by the town of Megeve, and over the mountains, to Sallanches. This is much the shortest route from Chamberry to Sallanches. The journey may be accomplished in one day from L'Hopital; but the road is stony and seldom travelled; and those who undertake it would do well to have provisions with them, and be certain with respect to the weather, as there are no tolerable inns where they could sleep.

After our repast, we began to ascend by a road cut in the side of a mountain, composed of dark carbonaceous schist, with veins of the mineral, called, by Werner, slate spar: a new and safer road was

forming along the bottom of the valley. Our road continued under the shade of the slate mountains on our right, to L'Hopital. About a mile on this side that town, we passed a large building, formerly a monastery, placed on a finely wooded eminence immediately above the valley. It was six o'clock when we arrived at L'Hopital, though we were not seven miles distant in a direct line from Faverge, which we passed at twelve o'clock, the road making a long détour round the mountains, forming nearly half an ellipsis. There is a foot-path across the mountains from Faverge to L'Hopital; and we were told that a stout man might walk from one town to the other in an hour and a half, though it is a journey of six hours by the carriage road. We alighted at the Hotel de l'Union, kept by les frères Geuif, where we found the accommodations good, and the charges fair, without any attempt to impose. The elder brother, who is the principal manager, is an intelligent modest man, and very obliging. We slept at this inn three different times in our peregrinations, and can recommend it to future travellers.

L'Hopital is a well-built town on the

north bank of the Arly, and nearly on a level with the river. Having been burnt down by the Austrians, the houses are new, and the streets are wide and spacious. It is a considerable thoroughfare, being situated on the direct road from the district of Beaufort, and the Tarantaise, to Chamberry; and, also, from the latter place, and from Annecy, to the new baths at Brida. There is a temporary wooden bridge over the river; but a fine stone bridge is now building lower down, to facilitate the intercourse with the Tarantaise, the old bridge having been destroyed by the Austrians, during a series of severe engagements, while Savoy formed a part of the French empire. Our landlord gave us an account of one of these rencounters between the French and Austrians. The Austrians were 8000 strong, and had possession of Conflans, which is situated on an eminence on the other side of the river. The French force consisted of only 1500 picked men of the 14th regiment of infantry. The Austrians took possession of L'Hopital three times, the French retiring in order to draw them into the plain, but as they would not advance, the French returned,

and drove them again over the bridge, on which several severe struggles took place, the combatants tossing each other into the river. The French officers, however, finding the enemy too numerous to be driven out of Conflans, retired to Chamberry, much against the inclinations of the soldiers, who fought with the most determined bravery. The Austrians lost 1800 men; and we were told that they evinced as much cowardice during the combats, as they did cruelty afterwards to the poor inhabitants of L'Hopital, which place they destroyed by fire. Fifty of the Austrians were buried in a part of the garden of our inn. The people of Conflans are said to have been jealous of the rising prosperity of L'Hopital, and to have endeavoured to incense the Austrians against them. It is melancholy to remark, how often the contiguity of two towns gives rise to the most deadly animosities between the subjects of the same state, who have no better cause for hatred, than that they live within *striking distance* of each other, to use the language of electricians.

After taking some refreshment, we crossed the bridge to Conflans, while sup-

per was preparing. Conflans is situated on a very commanding eminence over the Isere. Its ancient castles and monasteries, with the glittering domes and spires of its colleges and churches, give it, at a distance, a most imposing appearance. With the river and bridge in the fore-ground, and the rocks and finely wooded mountains behind, it forms one of the finest subjects imaginable for a picture; but on entering the town the charm was broken; the streets are narrow and gloomy, and the houses old and dirty; and its population has declined since l'Hopital has risen into consequence. The college is a large establishment, partly intended for the education of the clergy. The confluence of the Isere and Arly takes place just below the town, from which circumstance it obtained the name of Conflans. The rock on which Conflans stands, is mica-slate, better characterised than any I saw in this part of the Alps. It is covered on the western side by a coarse greywacke schist, inclosing fragments of rose quartz.

There is a fine view down the lower valley of the Isere, from the terrace, behind the church. While resting ourselves

there, after our long walk, we were all struck with the singular contour of one of the mountains behind l'Hopital, which we soon discovered was a striking resemblance of the profile of the historian Gibbon, in a recumbent posture. I took the outline, which is given without exaggeration, Plate III. I had the opportunity of comparing the sketch with the mountain at three distant intervals, and am satisfied it is faithful to the original; but the resemblance can only be seen to advantage in the evening. In the morning the seams of the stratification are visible, which destroys the illusion, but cannot change the outline, formed by the projecting edges of the thin strata. The Gibbon Horn, as it may be called, is seen as well from the bridge as from the church at Conflans.

The following morning, at half past nine, we proceeded down the valley of the Isere to Montmellian, in our way to Chamberry. The road is carried along the bottom of the mountains which form the northern boundary of the valley. The great chain of the Alps on the other side, here recedes and bends southward, and the country opens into an extensive plain, bounded by distant

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snow-capped mountains. I call the country on the south of the river a plain, for so it appears, when compared with the chain of the Alps which bounds it; but this plain is in reality diversified with numerous cultivated hills of considerable elevation. As far as I could judge at that distance, these hills, which range near the southern side of the river, rise to the height of four or five hundred feet. They are principally composed of the débris of rocks and alluvial soil, brought down from the Alps.

The Isere flows along a very broad bed, surrounding numerous small islands in its course. Near Fretterivé, about ten miles below Conflans, it receives the river Arc, from the valley of the Maurienne; and the Isere now contains all the waters that flow northward or westward, from the west of Mount Joli and the Col de Bon Homme, the little St. Bernard, Mount Iseran, Mount Cenis, and the mountains west of the Maurienne, along a waving line of one hundred and twenty miles, comprising all the higher Alps in the south of Savoy. It may easily be conceived, that the numerous streams and torrents from such an extensive range of mountains, swelled by the melting of the

snows, and united in one channel, would occasion, at times, vast inundations. These inundations have brought down immense quantities of stones, which have covered great part of the valley on each side of the river. Thus more than thirty thousand acres of the richest land have been rendered entirely barren and useless, between Conflans and Montmellian. The Sardinian government has long had it in contemplation to restrain these inundations by strong embankments; but I am inclined to believe, that, by widening and deepening the channels between some of the islands and shallows in the bed of the river, the ravage of these inundations would be more effectually checked, and at a much less expence.*

* Excepting at the times of great inundations, the Isere is a much smaller river than might be expected. When standing on the bridge at Montmellian, we may see all the waters of the south of Savoy, comprising an extent of 2000 square miles of the highest Alpine land of Europe, pass under our feet, in a stream not broader than the Thames at Richmond. If this fact were not sufficient to make us doubt the truth of the generally-received opinion, that lofty mountains are essential to the formation of large rivers, we may also instance the Rhone as it enters France at the Fort d'Ecluse. After receiving all the waters from the Haut Vallois, bounded

The distance from L'Hopital to Montmellian is about eighteen miles. After passing through St. Gilly, Greisy, Fretterive, and other small towns, we arrived at two o'clock at St. Pierre, where we rested our horses and took some refreshment.

About twelve miles from L'Hopital, we passed the castle of Miolans, placed on a lofty escarpement of rock under the mountains on our right. It was formerly an ancient baronial castle, but was purchased in 1523, by one of the Dukes of Savoy, and made the state prison of the duchy. It has formerly been an extensive edifice, though now much in ruins, and is surrounded by strong round towers, that seem to frown over the vale, as monuments of the oppression of past ages.

On approaching St. Pierre, we left the slate rocks, with their serrated summits, and the mountains on our right began to assume the same forms as those near the

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by the highest Alps in Switzerland; the streams from the Pay de Vaud, and the southern declivities of the Jura; and the waters of the Arve from Mont Blanc and the north of Savoy, yet these united currents scarcely form a river wider than the Severn at Worcester.

Lake of Annecy, presenting walls and turrets of limestone, resembling castles lifted into the sky, placed on steep verdant slopes. They are, in fact, a continuation of the same calcarious mountains, ranging from the head of the Lake of Annecy, to the south-west through the district called the Bauges, and terminating on the north side of the lower valley of the Isere. Their height above the valley is from 3000 to 4000 feet. They effectually screen it from the north and north-easterly winds, giving to this part of Savoy the climate and productions of more southern latitudes. We passed many respectable-looking country-houses and the remains of ancient castles. The abundant crops of wheat, barley, and maize, indicate the fertility of the soil. The hay-harvest was getting in, and reminded us of the hay-fields in England, and the barley was already cut, (June 26th,) though the spring of 1821 was unusually cold. The wheat also appeared nearly ripe. The slopes of the mountains on our left were covered with vines, which produce the finest wines of Savoy, particularly those of St. George and St. Jean de la Porte. The white wine of Montmellian is also much esteemed, but

though it does not appear much stronger than cider, it is *bien capiteux*, i. e. it is apt to get in the head. White mulberry-trees, for rearing silk-worms, abound near Montmellian, to supply the silk manufactories at Chamberry. Property here is much divided; but every thing seemed to prove a better style of culture, and more wealth and comfort, than in the parts of Savoy we had before seen.

We arrived at Montmellian at six o'clock. Before the destruction of the castle, it was a considerable town, and formed the western bulwark against the French. At present it contains about 1200 inhabitants, and though placed on the high road from Chamberry to Mont Cenis, there is not one tolerable inn. Below the town there is a handsome stone bridge of five arches. Here the two roads from Grenoble and from Lyons to Mont Cenis unite.

The castle of Montmellian was situated on a rocky eminence to the left of the road, about a mile beyond the town towards Chamberry. It is now in ruins, and only part of the walls remain. Formerly it was considered one of the strongest fortifications in Europe, and almost impregnable,

and it scarcely ever surrendered to a foreign power, but through the treachery of the commandants.

Henry the Fourth of France called this castle "une merveilleuse fort place, et le meilleur qu'il vit jamais." In the war with Charles Emanuel, in the year 1600, he despaired of taking it by force of arms. Sully ordered six pieces of cannon to be placed on a projecting rock, above the castle, which, after great labour, was at last effected. Henry, astonished at the success of the enterprise, ascended the place with his generals to reconnoitre the fort, but they were discovered by the garrison, who immediately discharged some pieces of heavy artillery, which, striking the rocks above, covered the king and his suit with a shower of stones and earth. On the first moment of surprise, Henry made the sign of the cross, when Sully smiled and said, "For once I acknowledge that your majesty is a good Catholic." Mémoires de Sully, tom. iii.

At last Henry obtained possession of the castle by the treachery of the governor, the Count de Brandis. His wife used to amuse herself with making glass beads with a

blow-pipe, and she sent a present of a necklace and ear-rings, of her own workmanship, to the wife of Sully, who had accompanied him to the siege. This was graciously accepted, and in return Madame Sully sent Madame la Commandante a handsome present of game and wine, with a message requesting her to obtain permission of the Governor to visit Madame Sully "pour dissiper ensemble les ennuis du siège." This was granted, and Madame Brandis spent three afternoons with Madame Sully. The crafty Frenchwoman, by the directions of her husband, insinuated herself into the good graces of her visitor, and the two ladies contrived together the terms of capitulation, as dictated by Sully, to which the governor was weak enough to accede. Monsieur Brandis had a conference with Henry, at the convent of the Dominicans, and agreed to surrender the castle, though the works had received no injury, and the garrison had provisions and ammunition sufficient to stand a long siege; so much so, that Count Biron, when he took possession of the castle, said that the place would really have been impregnable, had the governor done his duty. Despised by the

French army, Brandis hid his disgrace and treachery in Switzerland, of which he was a native.

The castle was finally demolished by the French, in 1703, and has never since been repaired.

At Montmellian the road to Chamberry leaves the valley of the Isere, and turns suddenly to the north, descending gently into a broad vale, which extends to the lake of Bouget, the waters flowing northward into the lake, from whence they pass, by a short channel, into the Rhone.

We arrived at Chamberry late in the evening, and alighted at the Hôtel de la Poste, one of the dearest and worst inns we met with on the continent. On a second visit to Chamberry, we were at the Hôtel de la Parfaite Union, opposite the cathedral, and were well satisfied with our quarters. The next morning, at four o'clock, I heard much noise and bustle in the streets, and, on looking out of the window, I was surprised to see the shops open, and the streets thronged with people, all eagerly engaged in talking with their neighbours. No cause can be assigned for opening the shops at so very early an hour, unless it be

to enable the inhabitants to discharge a portion of the talking fluid, which may have accumulated to a painful excess during the silence of the night. The Savoyards are certainly the greatest talkers in Europe.* Volney tells us that the French settlers in America do not thrive, for instead of building their houses on their farms, to be near their work, they pack them together for the convenience of talking: he adds, that a Frenchman will rise at four o'clock in the morning, in order to go round to his neighbours, and talk about it all the rest of the day. The shopkeepers at Chamberry cannot be actuated by this species of vanity, for where all do the same, there can be nothing to boast of.

Intending to return to Chamberry, after leaving Aix, the only objects of curiosity we visited were Les Charmettes, and the

* Physiologists may, perhaps, deny the existence of such a fluid in the animal economy, though it seems proved by experience, that speech is not so frequently employed to communicate ideas, as to relieve the speaker from a certain restless irritation; thus we invariably find, that those persons talk the most, who have the least to say. I have sometimes been utterly astonished at hearing the Savoyard peasantry keep up an uninterrupted flow of words for several hours.

house and grounds of Monsieur le Comte de B. I shall here introduce an anecdote connected with this gentleman, indicative of the state of moral feeling among the Savoyards.

Monsieur de B. is a native of Chamberry. He went to India in a military capacity, and entered into the service of one of the native princes. After some years he returned home, possessed of immense wealth, built a handsome mansion in the environs of Chamberry, which he has furnished in a splendid manner, and laid out his grounds in what is called the English style of gardening. He has also contributed largely to the improvement of l'Hôtel Dieu, and other public hospitals; has built, at his own expence, an asylum for the support of decayed tradesmen, and is constantly distributing large sums in alms. But notwithstanding his extensive charities, his name is scarcely ever mentioned to a Savoyard, without exciting the strongest feelings of deep-rooted aversion and indignation. On enquiring the cause of this, I was told that Monsieur de B. had betrayed his trust, and had sold Tippoo Saib to the English for an immense sum of money. I endeavoured

to convince them that this assertion must be false, as Tippoo Saib was never sold to the English, but was slain during the siege of Seringapatam, but I found it impossible to remove the impression. The fact appears to be, that Monsieur de B. was in the confidence of the Mahajee Scindeah, and commanded his infantry, and that, on leaving India, he transferred his regiment, which he raised at his own expence, to the English; but how far the charge of treachery may have any foundation in truth, I could not learn. The want of a free press in Savoy precludes the possibility of those discussions, which might have elicited the truth of this story in the only place where any interest is felt respecting it. I should not have thought it right to have adverted to the circumstance, but it is so generally spoken of in Savoy, and the public feeling and prejudice is so strong against Mon. de B., that it cannot possibly do him any injury by stating it. Though personally unknown to Mon. de B., I considered it a duty to correct what was said respecting his treachery to Tippoo, knowing it could not be true, and I nearly involved myself in a serious dispute by contradicting it, at

the public table at Aix, but fortunately I was supported by historic records, which were referred to. However they may be mistaken in the facts, the feelings of the Savoyards, on this subject, prove their high sense of honour and fidelity, for which they have ever been celebrated.

In England, if a man returns to his native place loaded with riches, if he is liberal in his distribution of them, keeps a splendid equipage, and gives good dinners, we seldom enquire by what means he acquired his wealth.

"Le vrai Amphitryon est celui chez qui l'on dine."
MOLIERE.

The house of Mon. de B., called Buissonrond, is much like the country mansions of many of our nobility. It is splendidly furnished in the English taste, and the rooms are ornamented with a profusion of pictures and engravings. The latter were chiefly English, and several of them were not the most decorous; nor was the want of propriety atoned for, by any superior merit in the execution. The Belvidere, or round tower, in the centre of the grounds, commands a fine panoramic

view of the magnificent country round Chamberry. It is several stories high, each divided into four small apartments, tastefully fitted up with couches, pictures, looking-glasses, &c.

From Chamberry to Aix-les Bains, the road passes along a valley or basin, which was once probably covered by the lake of Bourget, having on the west a narrow and lofty mountain-range, called Le Montagne du Chat, and on the east a calcarious mountain, called Chaparillon, presenting its steep escarpements to the valley. The valley is extremely fertile; the lake of Bourget is concealed from the view by a low range of wooded hills. The distance from Chamberry to Aix is about ten miles. We arrived late in the evening, and as the principal hotel and the boarding houses were full, we were obliged to pass the first night at an inferior inn, where the landlady was very unwilling to take us in, as she well knew we should seek for better accommodations the next morning. The town is often so crowded, in the height of the season, that invalids who intend remaining here should endeavour, if possible, to arrive early in the day, otherways they may be put to great inconvenience.

The following morning we engaged to board at L'Hôtel de la Poste, but as the landlord had no rooms at liberty in his house, he procured apartments for us in the town.

Aix les Bains, in Savoy, has been celebrated for its thermal waters from the time of the Romans. It was called *Aquæ Allobrogum*, and *Aquæ Gratianæ*. The latter is said to be from the emperor Gratian, who is supposed to have repaired these baths during his abode in the country of the Allobroges, when he also built Grenoble.

Aix being a name given to many different places in Europe where there are mineral springs, we cannot doubt that it is a contraction of the Latin accusative Aquas, probably pronounced as the moderns pronounce Aix. The town has often been nearly burnt down; the last accident of this kind happened in 1739. Owing to these conflagrations, most of the archives of the town, with the vestiges of its high antiquity, have been lost or destroyed. The present town is built in the bottom of the valley, under a very high calcarious mountain, at the foot of which two abundant sources of hot water spring up. The situation is unfortunate, as the place in sum-

mer is extremely close and hot, from the quantity of warm water constantly running through the streets. Had the town been built on the rising ground a little above the baths, this inconvenience would have been avoided, and it would have commanded a fine view of the Lake of Bourget and the surrounding country.

Aix was formerly a walled town, with three gates. Excepting *La Grande Place*, the streets are very narrow, and most of the houses small. It contains about 1600 inhabitants. The antiquities entitled to notice consist of a Roman archway, called the Arch of Campanus, behind the church; a square building, supposed by some to be the temple of Diana, by others the temple of Venus, adjoining the ruins of the château of the Marquis of Aix, and the remains of a vaporarium, or vapour bath, with the seats formed of bricks and covered with marble, which have lately been discovered under the house of M. Perrier. A stone, with a mutilated Latin inscription, is placed inversely in the wall of the ancient château of Aix, which shews the little attention paid to Roman antiquities at the period when the château was built. Part of this

château was till lately occupied as a convent by the sisters of St. Joseph, but the community is now broken up.

The two thermal springs rise within about 300 yards of each other. The upper spring, or Source de St. Paul, improperly called the the Alum Spring, gushes from the rock beneath an antique archway. It has nearly the same temperature as the lower or sulphur spring, and is taken by some of the patients as a gentle aperient. It is occasionally used for douches. It flows in a stream, sufficiently large to turn a mill, and supplies a large bath or reservoir below, now used for the purpose of douching horses that have the lumbago or stiffness of the joints. The poor animals stand very quietly under the stream, which falls from a considerable height on their bodies, and the warmth of the water is evidently grateful to them. The sum paid each time is fifteen sous. This bath was formerly called *le Bassin Royal*, from Henry IV. of France having bathed in it when he had possession of Savoy, in 1600.

The lower spring is called *le Bain de l'Eau de Souffre*, or sulphur bath. The source is very abundant; its temperature is

from 37 to 38 Reaumer, or 117 Fahrenheit; but in rainy seasons, by an admixture with the surface waters, or cold springs, it is not more than 35, or 111 of Fahrenheit. It is nearly tastless, and emits the odour of sulphur, not that of sulphureted hydrogen. This spring is peculiarly eligible for the operation of douching, the water being precisely of the requisite temperature as it comes from the rock, and, owing to its elevated situation, it can be made to fall with different degrees of force from the requisite height, and in any quantity, without the trouble of pumping; whereas at Aix la Chapelle, the water is too hot, and the temperature must be reduced before it can be used. At Bath the douching is done by pumps, and the water issues from one small aperture; whereas, at Aix, in Savoy, there are two copious streams, constantly pouring into each douching cell, and two douchers to direct its application, who continue a brisk friction during the process, which is altogether different from the douching at Bath, and far more powerful. The following analysis of the waters at Aix were given by M. Bonvoisin, in the Memoirs of the Royal Academy of Sciences at

Turin, for the years 1784 and 1785. It is possible that they partake of the imperfection of chemical science at the period when they were made. I am not aware that any more correct analyses have been since made. In 28lbs. of water were found,

In the spring called Eau de Souffre.

	Grains.
Sulphat of soda - -	9
Sulphat of magnesia -	19
Sulphat of lime - -	11
Muriat of magnesia -	4
Carbonate of lime -	30½
Iron - - -	1

Hepatic gas, with a small portion of carbonic acid gas, about one-third of the volume of water.

In the same quantity of water, from the spring called Eau d'Alun.

	Grains.
Sulphat of soda - -	6
Sulphat of magnesia -	6
Sulphat of lime - -	18
Muriat of lime - -	4
Carbonate of lime -	32
Iron - - -	2
Muriat of lime - -	12

A particular kind of hepatic gas, combined with sulphurous acid gas, about one-third the volume of water.

Some observations on the geological position of these springs will be given in Chapter IX.

Till the year 1772 the sulphur bath was merely a large cave, cut in the rock, and divided by a wall into two apartments, one for the men, the other for the women, with an iron balustrade in front. At that period the king of Sardinia caused the present handsome building to be erected and fitted up, expressly for the operation of douching. The apartments for douching, to the number of fifteen, are placed in a semi-circular corridor, and in a lower story are two other rooms, for douching, into which the water falls with greater force.

On the south side of the building is the large bath intended for the royal family, with dressing rooms round it. There are also apartments where the poor are douched *gratis*. Each bath or cell is an arched vault about thirteen feet long, eleven wide, and twenty-two feet high from the top to the place where the patient sits. There are two apertures, or short tubes, by which the water descends in columns, as large as the arm, from the height of from eight to ten feet; it is carried off by channels in the floor, and runs down into the street. There are two men, called douchers, constantly in each cell, and two women, called

douchesses, in each of the women's apartments. Porters are also in attendance, to carry the patients home in chairs provided by the establishment. These chairs are placed on poles, with cotton hoods and curtains, so as entirely to cover the patient. It is the general custom to begin with taking one or two warm baths at home. A great number of chamber-baths are kept for the use of invalids, and they are filled with water brought from the hot springs, for which, with the use of the bath, only one franc each time is paid.

To persons who take the douche for the first time, the process is rather formidable. On entering the cell, when the door was closed, I seemed in darkness, and involved in dense vapour and sulphurous odours; but as my eyes became accustomed to the gloom, I could discern a feeble glimmering of light, entering by a little wicket above the door, covered with canvas; I then discovered two silent and nearly naked figures, whom I had not before perceived, standing with their bare arms extended, as if ready to seize me the moment I was undressed. It would have required no powerful aid of the imagination, in such a place, amid the

gloom and sulphurous vapours, to have transformed these figures into demons or tormentors of the inquisition; and the horrid yells of the douchers, in the neighbouring cells, to call the porters, might have confirmed the belief. On approaching the flight of steps, where I was to descend to take the douche, I drew back my foot, as I could not see where to set it down. This they attributed to fear, and cried out, "N'ayez pas peur; soyez tranquille; nous vous ménagerons doucement comme un enfant gaté." They then brought me under one of the streams of water that issue from near the top of the cell, and told me to extend my hands, in order to break the column of water, and distribute it gradually over my body, as it would be too painful and scalding if received at first in one stream. When I had stood under the water a little time I became accustomed to the heat: I then sat down, and the process of douching commenced. The water is made to pass through long jointed tin tubes, which are fixed on the two apertures where the streams enter. Each doucher takes one of these tubes, which they direct to different parts of the body,

with one hand, while the other hand is employed in rubbing the part on which the water falls. The first morning the douching only lasted five minutes, but the time was increased each succeeding morning, till I was able to bear the operation for twenty minutes or half an hour. When the douching was finished, the douchers set up the most horrid yell I ever heard, as a signal for the porters to enter, to whose care I was then consigned. They immediately enfolded my arms and body in a linen sheet, without drying the skin; over this they put a thick woollen wrapper, or blanket, tying up my feet; and, lastly, they bound my head round with a napkin. Thus equipped, you are precisely in the costume in which the ancients used to bury the dead, as may be seen in the pictures of the raising of Lazarus. You are then placed in one of the chairs above described, and the porters run with you through the streets, and up the stairs into your bed-room. This is the most terrific part of the ceremony: the stairs are generally very steep and narrow, and, as the porters ascend with great swiftness, it is difficult to preserve a balance. Should you fall, you

must roll down like a log, as your hands and feet are completely confined; but such is the dexterity of the porters, that accidents of this kind are unknown. The bed being previously warmed, the porters take off the woollen wrapper, leaving the wet sheet round your body: one man takes you by the shoulders, the other by the feet, and you are lifted like a corpse into bed. They wish you good morning, and depart. Your servant or attendant then covers you over with the bed-clothes, and leaves you for a longer or shorter time, according to the directions of your physician.* A profuse perspiration immediately succeeds, and generally continues till your attendant comes to release you from your confinement, warm your linen, and assist you to dress. Half an hour was considered sufficient in my case, but for rheumatism or palsy, the patients sometimes remain in bed three or four hours.

The operation is somewhat painful, and

* It may seem extraordinary that the patients should be suffered to remain so long wrapped in a wet sheet, but I never heard of any injury arising from it; and I am sure, by my own experience, that the perspiration was more profuse than if the skin were dried before being put to bed.

very exhausting; it may be aptly compared to purgatory, where all the peccant humours are to be expelled, by the continued modified agency of fire.

The whole expence of douching, including the porters, is only a franc and a half each time. Out of this the douchers and porters have four sous, or only one sous each; the remainder belongs to the government, and it is calculated that the king of Sardinia receives a clear revenue of about £1500 *per annum* from these baths. The douchers and porters are prohibited from receiving any presents individually; but there is a box at the bath, into which most patients, who have derived benefit from the douches, put money when they leave the place. This goes to a general fund for the support of the douchers and porters, in sickness or old age. The douching, in the height of the season, commences at three o'clock in the morning, and continues till two or three in the afternoon. The douchers continue constantly in the cells, to be ready for the patients. One of them, a fat old man, told me, that he began douching before three o'clock, and should continue till noon. It might be imagined that the ex-

posure to so high a temperature, for so many hours, would be injurious to the constitution, but he had been a doucher thirty years, and he said they were in general very healthy. In winter they employ themselves in weaving and other occupations. The season for taking the douches is from the middle of June to the latter end of September. Before or after that time douching is considered dangerous, the mornings and evenings being frequently cold. The annual number of patients varies from 1500 to 1800. A list, with the names and residences of all the visitors who arrive at Aix, is published by the government every week. It is seldom that patients remain at Aix more than three weeks or a month at one time, the process being too severe to be continued for a longer period without an intermission; but, in obstinate cases, the physicians generally recommend their patients to go away to recruit, and then to renew the douchings before the season is over. The waters are particularly efficacious in palsey, gout, rheumatism, sprains, and rigidity of the joints; also in scrophulous complaints and glandular swellings. There are several

physicians at Aix, but I can say nothing of their merits, from my own experience, as I relied on the clear and ample directions given me by Dr. Butini, of Geneva. Persons of delicate constitutions would do well to consult one of the resident physicians, who cannot fail to have much local knowledge of the effects of these powerful waters, and can direct their application in the safest manner.

When the community of les sœurs de St. Joseph was broken up, two of the sisters retired to a small house close to the church, where they keep a well-arranged apothecary's shop, and where prescriptions are carefully made up. They also attend the sick, and instruct the female children of the poor gratis. They appear to be about thirty-five years of age, are dressed like nuns, and are genteel and pleasing in their manners, with a slight expression of melancholy in their countenances, which renders them extremely interesting. It is impossible not to feel a profound respect for persons who thus make a sacrifice of all selfish and personal interests to promote the welfare of others. — Such are les deux sœurs de St. Joseph.

I have been more particular in the account of these baths, as their merits are not generally known in England, and I believe there is no place in Europe, where douching can be practised with so much advantage. There is water sufficient to douche a thousand persons a day, if the upper source were employed in the same manner as the lower or sulphur spring.

The drives and walks in the neighbourhood of Aix are very beautiful, but the town itself has nothing to recommend it. The French papers are taken in at the principal coffee-houses; and in the months of July and August, there are assemblies once or twice a week for cards and dancing. Besides the chars, donkies may be hired, with convenient ladies' saddles, the same as at Brighton.

The common people at Aix have less simplicity of manners, and are more obtrusive, than near the lake of Annecy, or in the south of Savoy, as may naturally be expected in a public and much-frequented watering place.

The garrulity of the Savoyards was in full activity in the streets from four o'clock in the morning until eleven at night. Bakers shops are the taverns of Savoy for the

labouring classes, unfortunately there was one behind the house where we lodged, and the incessant talking there, in addition to the noises from the street, made us frequently regret our removal from the quietude of Chateau Duing.

The public dinner at La Poste was announced at half past one, and we supped at about half past eight. The table was generally well provided, particularly with excellent fish from the Lake of Bourget. The company, amounting to about thirty, consisted of French, chiefly from the vicinity of Lyons, Valence, and Grenoble, a few Swiss, some natives of Savoy, two English families of ladies, and ourselves. Our number was often increased by occasional visitors, as Aix lies on the post-road from Geneva to Chamberry. During meals our ears were not annoyed by bad music, as is frequently the case in watering-places; but we had no lack of conversation. A gentleman from Neufchatel, who sat near the head of the table, and whom I at first mistook for an Englishman, both from his appearance and tone of voice, took the lead. Fortunately for the company, he was a man of sound sense and much information,

and spoke French distinctly; he contrived to touch upon subjects which elicited general conversation. This was no mean art in a country where neither religion nor politics could be publicly discussed; for we could not forget that we were under the dominion of an absolute prince, governed at the time by a foreign power still more despotic. Indeed, the issue of the insurrection in Piedmont was fresh in the minds of every one; and those who approved and those who censured it, all joined secretly in execrating the perfidious policy of the Austrians, who were inciting the Sardinian government to acts of cruelty and oppression against the most respectable families, in order to excite disaffection, merely as a plea to prolong and perpetuate their own possession of the country. Among the company were two characters I cannot soon forget: one an opulent merchant from Lyons; the other, his less successful friend, from Valence, whom he had brought at his own expence as a companion. The first was about fifty-five years of age, rather low in stature, but corpulent, smooth, and sleek, with regular features, light blue eyes, and an air of good-humoured satis-

faction in his countenance, as if he looked always on the sunny side of the vale of life, and regarded this as the best of all possible worlds; he had, withal, a certain degree of conscious importance, derived from the possession of wealth. He was dressed in a sky-blue coat, his hair was powdered and tied in a club, and he wore a large hat when he walked out. His friend, somewhat older, was tall and meagre, and had a thoughtful dissatisfied look; his lips were curled into a settled snarl, and the whole expression of his countenance indicated a mind not morose by nature, but deeply soured by disappointment, and disposed to look at the dark side of objects, and to cry out with the preacher, "All is vanity and vexation of spirit." The latter Platonists maintained, that there is an intimate connection between the physical and intellectual worlds, and that each element and property of matter has its corresponding genius residing in the intermundane space: according to this system, one of the friends might be supposed to represent the genius of Oil, the other that of Vinegar. Be this as it may, Oil and Vinegar were the names by which the two friends were known in

common parlance among ourselves. It was highly amusing to see them at dinner, — while Vinegar was grumbling and expressing his dislike of the place, his want of faith in the waters, and his disinclination to eat; Oil, with the most placid good nature, looked round the table for the choicest morceau to put by stealth on the plate of his friend, who generally muttered his disapprobation at first, but was always coaxed into eating a good dinner. *

* The terms we paid at L'Hotel de la Poste, were six francs per day each, for dinner, supper, wine, apartments and linen, with a basin of bouillon in the morning. Those who prefer an English breakfast, provide it at their own expence, as also tea or coffee in the afternoon. There are several respectable boarding-houses, where the terms are nearly the same.

CHAP. IV.

THE LAKE OF BOURGET. — MONASTERY OF HAUTE COMBE. — VICINITY OF CHAMBERRY. — LES CHARMETTES.

The valley in which Aix les Bains, in Savoy, is situated, is extremely fertile, producing abundant crops of wheat, also vines, fruit, and silk-worms. I have before mentioned that the valley extends from Chamberry to the lake of Bourget, running nearly due north; its width, including the breadth of the lake, varies from two to five miles. The mountains on each side rise to the height of from 3000 to 4000 feet; those on the eastern side present their bare escarpments to the valley. The Montagne du Chat, on the west, is a steep, sharp ridge, which extends from several miles south-west of Chamberry, to the lake de Bourget, which it approaches near its southern extremity. It then forms the western bank of the lake, dipping into the water at an angle of sixty degrees, affording no space

for a road, or even a landing-place, except in one or two points. At the part opposite Aix, this mountain is too steep and bare to support vegetation, except a few scattered pines; but near Haute Combe its lower flanks are richly covered with wood. The almost unbroken line of the *Montagne du Chat*, takes away from the beauty of the lake in the morning, but in the afternoon the whole western side is thrown into a deep shade of neutral tint, which gives relief to the rich scenery on the opposite shore, and to the distant Cottian Alps, with their numerous snowy pinnacles on the south. Here, as well as at the lake of Annecy, the strata of the mountains on the west, dip to the water, and those on the east present their escarpments to it, but on the lake of Annecy, the mountains that present their escarpments are brought close to the lake, and those which present their backs on the western side, range at some distance from it. On the lake of Bourget it is just the reverse. No person can form an adequate idea of the great beauty of this lake by seeing it from the shore, near Aix, with the bare back of the Montagne du Chat in front. It is only

from near the middle of the lake, or at its southern end, that the variety and magnificence of the scenery present themselves to the eye of the observer with their full effect. The lake of Bourget is about ten miles in length from north to south, or rather from N.N.W. to S.S.E; its breadth varies from two to three miles. At the northern end the waters of the lake flow into the river Rhone, by a passage about six miles in length, called La Savière.

As the Rhone is here navigable, the lake of Bourget has a direct communication with Lyons and the Mediterranean; and thus a channel for commerce is opened with all the southern and midland parts of France, which might be of incalculable advantage, were the trade between France and Savoy left free. At present the navigation of the Rhone is of little use to the Savoyards; coal is, however, brought from Lyons by this conveyance for the use of the blacksmiths, and landed on the east bank of the lake. It would be extremely easy to carry a canal from the lake of Bourget to Chamberry, along the valley, near the bed of the river Leysse, which flows from Chamberry, and is the principal feeder of the lake. When the

Rhone is much swelled, it rises above the level of the lake of Bourget; and instead of receiving the waters from it, by the short passage or outlet, on the north end of the lake, it pours a part of its own waters by this passage into the lake itself, and occasions inundations at the other end. There cannot be a doubt that the lake of Bourget once extended as far south as Chamberry, and covered the plain or basin, in which that city is built. At that time the low range of hills in the valley on which the village of Tresserve stands, most probably, was an island. The lower part of the valley, near the lake, is still a rushy swamp, and has been gained from the water at no distant period.

That the lakes in Savoy, in Switzerland, and in our own country, are gradually lessening, must be obvious to any attentive observer, though the progress of their diminution may, in some instances, be very slow. On the lake of Geneva we have fortunately a chronometer to mark the progress of the diminution. The upper Rhone enters the lake at the N.E. end, and brings down the débris from a line of Alps of nearly one hundred miles in length, on each

side the valley through which it passes. The immense quantity of sand and stones thus brought down, and deposited near its entrance, must occasion the land to advance into the lake; in proof of which Port Valois, the ancient *Portus Valesiæ*, which is now situated about two miles from the mouth of the Rhone, was a port at the head of the lake, in the time of the Romans.

The waters of the lake of Geneva are said to be gaining on the land in some parts of the southern shore. A gentleman residing at Colligny, immediately above the lake, informed me that there were formerly quarries at the bottom of the hill, which supplied Geneva with building-stone. They are now covered by the water of the lake, and may be seen under its surface.

It has been supposed that the submersion of these quarries was occasioned by the land on the opposite side having been encreased by débris, carried there by the Rhone or currents, thus throwing the water back on the southern bank; but this explanation cannot be admitted, unless the quarries had been always lower than the level of the lake; for the water could not rise on the southern side, without the gene-

ral level of the lake had also been raised, which is not the case.

A subsidence of the strata seems required to explain the submergence of these quarries, — a subsidence which was probably so gradual as to escape notice, except by its effects on the banks.

Accurate observations on the relative levels of different parts of the earth's surface are of too recent a date, and have been too seldom repeated or verified, to enable us to ascertain whether the strata have sunk down to any considerable extent since the world has been inhabited by man. There are many facts, however, in our own country, which might lead us to infer that a gradual subsidence in certain parts is now going on. Be this as it may, the changes that are taking place in many lakes, can be satisfactorily accounted for by visible causes. Thus, the lake of Bourget is diminishing at the southern end by the débris, brought down by the river Lysse, and on the eastern side by the débris from smaller rivers, which flow into it, and the lake of Annecy is diminishing at the southern end, and on the western side, from similar causes; but

I could not learn that the water is gaining on the land, in either of these lakes.

The lake of Bourget, according to Saussure, is 76 toises lower than the lake of Geneva, or only 740 English feet above the Mediterranean. Its greatest depth is on the western side, near where the strata dip into the lake, this proves the acute angle at which they descend; the depth of the lake being 254 feet, near the shore.

The lake of Bourget abounds in excellent fish, particularly the ombre chevalier, lavarets*, trout, and pike of fine size and flavour. There are the remains of several ancient castles round the lake, particularly Chateau Bourdeaux, nearly opposite Aix and Chatillon, placed on a hill, at the northern end. But the most remarkable objects are the ancient monastery and church of Haute Combe, on the north-western side of the lake, and La Fontaine de Merveilles, an intermitting spring behind it. We formed a party to visit Haute Combe, and engaged a boat with four men to row us over. We were

* The Lake of Bourget is celebrated for its lavarets, a species of fish nearly allied to the trout, and the ombre chevalier, *Salmo Umbla*, Linnæus; its body is without spots; its flesh is richer than the common trout.

nearly two hours crossing the water. The situation of the monastery could not have been better chosen for entire seclusion from the world. The Montagne du Chat, which forms the western boundary of the lake, descends so precipitously into the water, as absolutely to prevent the possibility of landing, except in a few situations; but at Haute Combe it retires, and forms a sheltered recess, surmounted by forests of chesnut and walnut trees, beneath which are vineyards, corn-fields, and orchards. The monastery is placed on a rocky eminence, at the edge of the lake.

Though the monastery of Haute Combe is of high antiquity, and was one of the most considerable monastic institutions in Savoy, it has rather the appearance of a large modern mansion, than of an ancient religious establishment. The monastery was founded in 1125, by Amedeus, the third count of Savoy. The church was formerly the burial-place of the counts and dukes of Savoy, who built here two magnificent Gothic chapels, ornamented with gilding, pictures, and bas-reliefs in the taste of the thirteenth century. Among the monuments destroyed at the Revolution, in

1793, was one of Boniface, archbishop of Canterbury, and primate of England, who died in 1270. He was a Savoyard. The church belonging to the monastery was greatly injured at the time of the French Revolution, and was converted into a manufactory for china and earthenware, which, however, did not succeed. The furnaces and broken pots and pans still remain. The gardens round the monastery are kept in good order, part of the building being occupied as a dwelling-house by the present proprietor.

In the church and sacristy there were formerly many curious paintings and relicks, incased in gold and silver, with vases and other ornaments of great value. The ancient chronicles of Savoy were also kept here. We saw the apartment where these treasures had once been deposited; it was surrounded with recesses, fitted up with shelves and sliding doors; but their contents have long since disappeared: a few paintings, however, of high antiquity remained. One of these, which was on the ground, leaning against the wall, attracted our attention, from the singular attitudes of the figures. It represented a saint stand-

ing at a desk, in the act of writing a book. His head was directed upwards, with the mouth open, preserving an air of the most quaint, but sanctimonious seriousness: he was surrounded by monks. Above, in the clouds, was the Virgin, leaning over and regarding him with affection. Across the picture there appeared to be a ray of light descending to the saint, the meaning of which, from its strange position, we could not comprehend. The ladies and gentlemen of our party had been poring over it for some time in doubtful conjecture, when, on turning the picture to the window, we perceived that what we had mistaken for a ray of light, was something more substantial and nourishing; the Virgin was pressing her bosom with her hand, and squirting a stream of milk very adroitly into the mouth of the enraptured saint below. The unexpected discovery of this novel mode of inspiration completely overpowered our gravity, and excited an involuntary laugh from all the party, without regard to the feelings of our conductor. We were unable to learn the name of this favoured saint.

About half a mile behind the monastery,

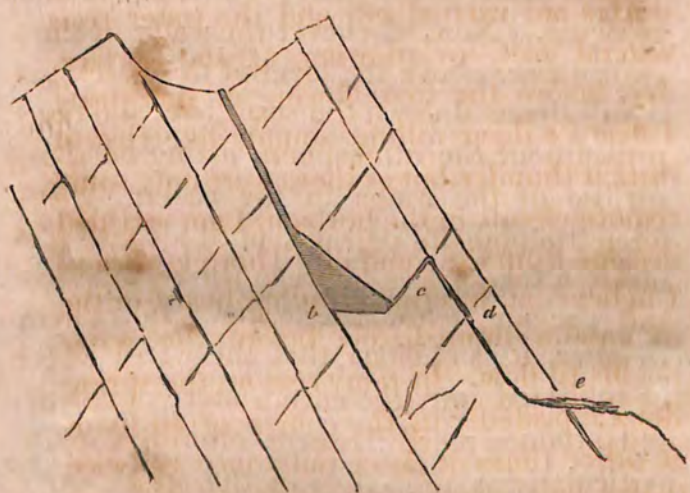
ascending through some beautiful fields, we came to a small plain, on which there is a circular grove of trees, with seats. It is close by the Fontaine des Merveilles. It was under the shade of this grove that the brethren from the monastery used to regale themselves during the heats of summer; the fountain supplying them with the clearest and coolest water, to mix with their wines. A sybarite could scarcely conceive a situation better chosen for luxurious enjoyment. It was a bright but sultry day in July; we brought provisions, intending to dine in the grove, and wait for the flowing of the fountain. We were exceedingly fortunate; for after standing at the spring a quarter of an hour, we retired to take our repast, leaving a boy to watch the fountain: but we were scarcely seated, before we heard the signal, and running to the place, we saw that the water was just beginning to flow. In a little time it ran with considerable force and noise, filling the reservoir: it then abated, and the water in the reservoir began to sink again; the whole process lasted about twenty minutes. About an hour afterwards we had another opportunity of seeing it from

its commencement. It not unfrequently happens, that persons who visit the place, wait for some hours, and return without witnessing the flowing of the spring, the period of intermission being very irregular.

The spring issues near the foot of the mountain, just at its junction with the elevated plain I have before mentioned. The natural basin into which it flows has an irregular stony bottom, and will only permanently retain water to a certain height, but when the spring flows it fills faster than the waters are carried off, and the water rises several feet, overflowing at the surface. Just before the first flowing of the spring I heard a deep rolling sound, like that of distant thunder, but as there were only some remote clouds in the horizon, I am satisfied it came from the fountain. There is always, I believe, an internal gurgling heard in the mountain, immediately before the water begins to flow. In rainy seasons the spring flows repeatedly in the course of an hour, at other times it flows only once or twice in the course of the day.

That the water in ebbing springs acts on the principle of the syphon, in that well known philosophical toy called Tantalus'

cup, was formerly generally believed. Some modern writers have recently attempted to controvert this opinion. Here, however, the stratification and structure of the mountain, present one of the simplest cases that can possibly be imagined, of a natural syphon formed in the interstices of the strata-seams; for let us suppose the annexed cut to represent a section of the mountain, with the strata-seams dipping at a very acute angle.



It frequently happens in these mountains, that there are vacant interstices in the

strata-seams, sometimes these open so wide as to form caverns; let us suppose one of these caverns at *b* closed at the bottom, into which the water is constantly infiltering from the seams; suppose a crack or transverse seam *c* passes from the cavern to the next strata-seam above at *d*, along which there is an interstice downwards to an aperture at *e*; as these mountains are traversed by cross seams nearly as regular as those of the stratification, all the conditions here stated may well be supposed to occur. Now, whenever the water in the cavern rises above the level of the crack *c*, it will descend down the seam to *e*, and the pressure of the atmosphere acting on the surface of the water in the cavern, will force it along the passage, until a communication takes place between the air above, and the air below the water. In rainy weather, it is obvious that the water will be infiltered into the cavern more rapidly, and produce more frequent intermissions, particularly as the edges of the strata are exposed to the direct action of the rain.

In returning from Haute Combe, we kept on the western side of the lake, to

see several cascades that fall into it near the ruins of Chateau Bourdeaux. When upon the lake, or at the upper end of it, there is a fine view of the mountains south of Chamberry, and beyond these, the snowy summits of the Cottian Alps bound the horizon. The immediate scenery round this end of the lake is also extremely rich and varied, though the meadow which terminates it is marshy; I have before remarked, it has once been part of the lake.

We made another excursion to Grisey, a small village four miles from Aix, on the high road to Geneva, to visit a waterfall, which is much spoken of from the melancholy fate of a young lady, who fell into the torrent a few years since, in presence of her friend, the Queen of Holland, and her suite. A river has here excavated a profound ravine in a rock of limestone, which is, in fact, a hard and nearly white marble. In rainy seasons, before falling into the ravine, the water spreads over a broad floor of this limestone, but at other times, when the river is not so full, it pours along a number of deep narrow channels, and is seen at a great depth, boiling, foaming, and

lashing the rocks, before it unites again into one stream, to bound into the abyss below.* The sides of the surrounding rocks are richly clothed with wood, and other streams, which fall from the heights above, greatly increase the picturesque effect. Over the chasms it is the custom to lay planks to enable the spectators to pass, and observe the fantastic shapes into which the rocks are cut by the water. As la Baronne de Broc was passing over one of these planks, her foot slipped, she fell into the deep chasm, and was impetuously carried down the stream to meet her fate. Before

* On the floor of the rock in which these deep channels or chasms are excavated, there are numerous round cavities, bellying out like caldrons, with stones lying at the bottom of them. These stones are brought down by the current, and wear holes in the surface of the rock; and as the stones sink deeper and deeper, the cavities are enlarged by eddies formed within them. Fresh stones and débris occasionally fall into these cavities, and serve as instruments for their further excavation, until the sides of the neighbouring cavities are worn away and they unite, forming still larger cavities or cauldrons. I am inclined to believe that this is the most speedy process which nature employs in the excavation of hard rocks, to enlarge the beds of rivers, where the passage is confined. At the fall of the Valteline at Belgarde, the same process is going on, and I have seen similar cauldrons at the fall of the Wharfe, called the Strid, in Bolton Park, Yorkshire.

arriving at the great fall, she must have been stunned and rendered insensible to the horrors of her situation, by the force of the current, and the collision against the rocks on each side. The body was immediately found, and every means tried to restore animation, but without success.

On one of the rocks, near where the accident happened, the Queen of Holland has had a small monument erected, on which is the following inscription:

"Madame la Baronne de Broc, agée de 25 ans, a peri sous les yeux de son amie, 10me. de Juin, 1813.

"O vous qui visitez ces lieux, n'avancez qu'avec précaution sur ces abymes. — Songez à ceux qui vous aiment."

It is possible that some persons may consider this inscription as tainted with French affectation; but to me it appears simple and pathetic. Had precisely the same sentiment written in Latin, been found on an ancient sepulchral urn, I am very sure we should have extolled it as a specimen of genuine pathos, in the purest style of good taste.

Having now completed my douches at Aix, of which, to say the truth, I was most

heartily tired, we returned to Chamberry, to examine some of the most interesting objects in its vicinity, particularly the remains of the fall of Mont Grenier, one of the most awful events of the kind on record, or, at least, one which has left the most distinct traces of its extent and magnitude, after the lapse of nearly six centuries. From Chamberry we proposed going back again to L'Hopital, in order to ascend the upper valley of the Isere, and visit the district called the Tarantaise, which has hitherto been scarcely noticed by English travellers. My principal inducement for taking this route was to examine some thermal mineral waters, which had been recently discovered at Brida. After this, it was my intention to repass the Lake of Annecy, to ascertain some circumstances respecting the structure of the mountains in its vicinity, in consequence of observations I had made on similar mountains since I left Duing. — We also proposed going to Chamouny before quitting Savoy.

In taking my leave of Aix, it is but justice to state, that we found the people of the place obliging and honest, and we heard

no complaints of them from any of the other visitors.

We left Aix on the 24th of July in a char-à-côté. About four miles from Aix, I noticed in the valley a mass of alluvial soil and boulders of great depth, over which the road passes. This mass was probably brought there when the whole valley was a lake. Just before arriving at Chamberry, I stopped to examine some quarries on the east side of the road, the stone of which bears a strong resemblance to our grey lias limestone; but there were no fossils in any part of it which I saw. The city of Chamberry has often been described, as it lies in the high road from Lyons to Turin. The walls are at present removed, and the space they occupied is planted and laid out in gardens: the streets are dull and narrow; and none of the public buildings are particularly worthy of notice, except the hospital of L'Hôtel Dieu, the cassern for the soldiers, and the manufactory for silk gauzes, for which Chamberry has long been celebrated. The city contains about 10,000 inhabitants. The country round Chamberry is extremely fertile, and is embellished with numerous villas and gardens.

In the afternoon of our arrival we visited a cascade, called Le Bout du Monde, being at the termination of a valley, which has no outlet. The road to the cascade turns off to the left from Chamberry, opposite the mansion of M. Boigne, and passes by the side of the river Leysse, which gave us an opportunity of seeing the immense stone wall which has been built to form an embankment against the inundations of the river. This wall extends several miles, till it joins a low range of rock that projects into the valley. The river takes its rise in the high mountains, situated on the west and south-west of Chamberry, that form part of the boundary of the district, called the Bauges. The rapid melting of the snows from these mountains, has frequently occasioned such immense and sudden floods, as nearly to destroy the city of Chamberry. Eight of these great inundations have been recorded between the years 1348 and 1808. The most formidable of these were in the years 1550 and 1551, when the hospital of St. Francis and a great extent of the walls of the city were thrown down, and the streets were passed in boats and rafters for three days. The

cascade of Le Bout du Monde is formed by the river Doria, one of the branches of the Leysse, which, descending from the mountains, is thrown over a perpendicular ledge of rock of considerable elevation, and would be a very striking object if it were in a more favourable situation; but the approach to the fall is blocked up by a paper-mill, through which you are obliged to pass to see it; and the buildings of the manufactory injure the effect. This mill formerly belonged to M. Montgolfier, the first aëronaut. The rocks here present the most perfect horizontal stratification I have any where seen in Savoy. The strata are not more than two or three feet thick, and are separated by soft schist or sandstone. Into these divisions of the strata, the water has penetrated, and formed several channels, through which it spouts out in numerous separate jets d'eau, at a considerable distance from the main cascade. These smaller cascades, spouting out of the middle of a perpendicular wall of rock, have a singular effect, appearing like artificial accompaniments to the grand fall.

The mountains above the Bout du Monde, as I have before mentioned, form

part of the barrier, which separates the Bauges from the rest of Savoy. The Bauges, formerly Bovilis, or the country of cattle, is a district, containing thirteen communes or parishes, and more than ten thousand inhabitants; it is surrounded by a wall of calcareous mountains, and is only accessible through certain cols or passages, and is therefore seldom if ever visited by strangers. The mountains which we saw on the south-west of the lake of Annecy, were in the Bauges, or formed part of its eastern boundary; and the mountains on the north, in the lower valley of the Isere, from near L'Hopital to Montmilian, and from thence to Chamberry and Aix, form the southern and western boundary of this district. The impossibility of procuring a horse or mule when I was at Chateau Duing, prevented me from visiting the Bauges, from which I was distant not more than eight miles in a direct line. The inhabitants of the Bauges are principally engaged in a pastoral life, and export a considerable quantity of butter and cheese; the latter is said to be of an excellent quality. There are some iron forges and nail manufactories here. The

iron is procured from the Maurienne. The Bauges is one of those remarkable districts, of which there are several in Savoy; they contain numerous parishes and villages, nearly isolated from the world by impassable mountains. It is in fact more completely shut in than the valley of Thones, described in the second chapter. There are five principal mountain-passes or cols in the Bauges, which, in certain seasons, are entirely closed. But little wheat is grown there; oats, barley, rye, and potatoes are plentiful, and these with cheese and milk, form the chief food of the inhabitants. There are wolves and bears, with the roebuck and the chamois in the mountains; and they abound in red partridges, pheasants, and grouse. I did not enquire whether the peasants in this district, speak French, or only the patois. In the frequented parts of Savoy they speak both.

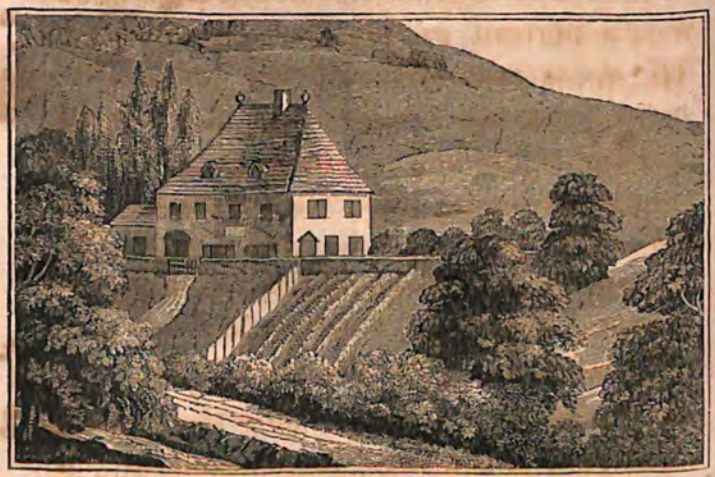
On returning from Le Bout du Monde, we ordered our voiturier to drive us to Les Charmettes, once the residence of Madame de Warrens and of J. J. Rousseau. We had visited the place when we passed through Chamberry to Aix; but I wished to see the house again, as the upper

rooms were locked up, when we were there before.

My principal object, however, was to re-examine the mill-stone quarries at the foot of the hill leading to Les Charmettes. The stone at these quarries is of a brownish gray colour; hard and frangible, with a flattish conchoidal fracture. The first time I saw it, I supposed it to be a chert or hornstone, similar to some I had seen interstratified with limestone, at the head of the lake of Geneva; but on examining a specimen which I had taken with me to Aix, it proved to be limestone; and as I was not then aware that limestone was ever used for grinding corn, I imagined that I must by mistake have broken the specimen from an upper or under stratum, instead of the mill-stone stratum. On this second visit, however, I found that it was true limestone; and I was informed that these mill-stones answer the purpose very well for grinding corn, but they are not so durable as those made of mill-stone grit. In countries where siliceous mill-stones cannot be procured, but at a great expense, perhaps the knowledge that hard limestone may be used instead, will prove useful. The

mill-stones at this quarry are cut out of the rock upon the spot. The strata are of the proper thickness, and nearly horizontal. A circle is drawn of the diameter required, and the surrounding parts are chipped away. Wedges are then driven in between the strata, and the stone is raised by levers.

Having satisfied my curiosity respecting the stone quarry, we proceeded to Les Charmettes, up a steep ascent, not very safe or easy for a carriage, along a shady glen, with sloping cultivated fields on each side; and to the left of the road is a rivulet which murmurs in its rocky channel, forming several little waterfalls in its descent. The lofty mountains, in the neighbourhood of Chamberry, are hidden from the view in ascending; and the whole of this retired valley bears a striking resemblance to some of the wooded glens in Hertfordshire. It is in character truly English. To the left of the road, opposite the house, is the grove of chestnut-trees mentioned by Rousseau, though the present trees appear to be of a more recent date. Every thing, in fact, remains very nearly as Rousseau described the place in the year 1736.



The house and garden are at a little distance from the road to the right. In ascending, we passed three or four white houses, with green window-shutters, which we mistook for Madame de Warren's; but it is the last in the valley. A French gentleman was waiting at the house for the keys of the upper apartments, which are rarely shown to strangers. After some delay and difficulty, the keys were sent. The lower rooms are nearly unfurnished. In the parlour, there is a miserable portrait of Rousseau, representing him as a very old man, with the Contrat Social in his hand. Opposite, is a painting, which the

woman who showed the house assured us was a portrait of Madame de Warrens. The room was dark, and the picture obscure; but, on a close inspection, I saw that the figure was originally intended for Omphale spinning; and Hercules was holding the distaff; but he was nearly obliterated. Rousseau would have been highly amused, could he have anticipated this transformation. The chamber of Madame de Warrens is up stairs, facing the garden, and out of it is a small room fitted up as a chapel or oratory. The room formerly occupied by Rousseau is over the front door.

From the upper windows we had a fine view over the distant country, illumined by the crimson glow of the setting sun, which, blending with the reflection of the deep azure of the sky, spread a flood of purple light over the mountains, giving to the landscape an enchanting softness and transparency, such as I had never before beheld. Under a climate like this, amid the grandest and most beautiful scenery, we need not wonder that the ardent and intensely susceptible mind of young Jean Jacques

caught the inspiration and enthusiasm, which breathe through all his descriptions of Nature. On the hill, behind the house, there is a still more extensive view; it was there that Rousseau, as he informs us, was accustomed to take his early morning walk, to observe the rising sun, and offer up his oraisons.

It was probably the vivid recollection of this scene, that afterwards inspired that glowing description of the opening of the morning, in the third volume of his Emile; a description, perhaps, unrivalled*.

* On le voit s'annoncer de loin par les traits de feu qu'il lance au devant de lui. L'incendie augmente, l'orient paroît tout en flammes: à leur éclat on attend le soleil long temps avant qu'il se montre: à chaque instant on croit le voir paroître; on le voit enfin. Un point brillant part comme un eclair, et remplit aussitôt tout l'espace; le voile des ténèbres s'efface et tombe: l'homme reconnoît son séjour, et le trouve embelli. La verdure a pris durant la nuit une vigeur nouvelle; le jour naissant qui l'éclaire, les premiers rayons qui la dorent, la montrent couvert d'un brillant réseau qui réfléchit à l'œil la lumière et les couleurs. Les oiseaux en chœur se réunissent et saluent de concert le père de vie; en ce moment pas un seul se tait. Leur gazouillement foible encore est plus lent et plus doux que dans le reste de la journée, il se sent de la langueur d'un paisible reveil. Le concours de tous ces objets porte aux sens une impression de fraîcheur, qui semble pe-

On the front of the house is an inscription, placed there by Herault Desechelles, when he was commissioner from the Convention in 1792. The poetry has nothing to recommend it; but it gives a tolerably correct picture of the extraordinary character who once resided here.

Reduit, par Jean Jacques habité,
Tu me rappelles son génie,
Sa solitude, sa fierté,
Et ses malheurs et sa folie.
A la gloire, à la vérité,
Il osa consacrer sa vie,
Et fut toujours persécuté,
Ou par lui-même, ou par l'envie.

"Retreat, inhabited by Jean Jacques, thou recallest to my mind his genius; his solitude; his pride; his folly, and his misfortunes. He dared to consecrate his life to truth and glory; and was always persecuted either by himself or by envy."

The numerous memoirs and letters of the cotemporaries of Rousseau which have

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netrer jusqu'à l'âme. Il y a là un quart d'heure d'enchantement, auquel nul homme ne resiste: un spectacle si grand, si beau, si délicieux, n'en laisse aucun de sang-froid.

been published within the last few years, if taken collectively, serve to remove much of the mystery in which some parts of Rousseau's history have been involved. There certainly existed a combination against him, to injure his reputation, and drive him out of society, formed among persons calling themselves his friends, but who were rendered malignant and envious by the great impression his writings had produced.

They were sufficiently acquainted with his weakness to be able to torment him without committing themselves.

Grimm, Diderot, and the coterie of Madame D'Epinay, were the principal actors. Voltaire, though equally envious, was a more open enemy of Rousseau's, and publicly endeavoured to overwhelm him with ridicule. Theresa, the woman whom Rousseau had unfortunately married, was artful and unprincipled; having obtained his entire confidence, she endeavoured, by misrepresentations, to drive away all his real friends, in which she too well succeeded; nor was her treachery and faithlessness discovered till the last, when it

led the wretched husband to the act of self-destruction.*

There appear to be sufficient grounds for believing, that the mind of Rousseau, so acutely and morbidly sensitive, had been wrought up to a state of frenzy and settled derangement for some years previously to his death; of this he was himself aware. He had, it is true, intervals of repose, when the brighter scenes of early life flitted before his fancy, like a soothing, but melancholy dream; "it was the memory of joys that were past, still pleasing and mournful to his soul."

It is particularly deserving attention, that the charge of inconsistency which the enemies of Rousseau have so repeatedly fulminated against him, is greatly deprived of its force, if duly considered; for though it be true that certain parts of his life were at variance with his doctrines, it should be borne in mind, that the acts for which he has been most condemned, were committed before he became a teacher of vir-

* A work has been lately published at Paris, entitled, "Histoire de la Vie et des Ouvrages de J. J. Rousseau, par M. Pathay," in which the proofs of suicide are stated.

tue; and surely the relinquishment of bad habits, ought not to be met by accusations of the want of consistency.

Madame de Warrens, before her death, inhabited a small house in the village of Lémenc, a few miles from Chamberry, and is buried in the church. Among her other commercial speculations, she formed a company, in conjunction with Mademoiselle des Mauhes, for working a bed of coal in the commune of Magland, in the year 1756. The difficulty of carriage caused it to be abandoned. We were told at the baths of Brida, by the Countess de V. of Chamberry, whose grandmother was acquainted with many of the ladies mentioned by Rousseau in his Confessions, that Madame de Warrens at one time established a manufacture of porcelain, or earthen ware, in the suburbs of Chamberry, and that young Rousseau was engaged in superintending it. He has omitted to mention this circumstance, though he informs us she entered into several commercial speculations, (without naming them,) in which he assisted her. Had the pottery been successful, Rousseau might possibly have been fixed for life in that occupation, and instead of interesting

the world with Julia and Emile, all his remaining works might have been a few earthen-ware shepherds and shepherdesses, with broken limbs and noses, ornamenting the chimney-pieces of the country inns in Savoy, the fragile relics of the genius of Jean Jacques.

How many apparently fortuitous circumstances conspired to snatch Rousseau in his youth from that oblivion, to which he seemed doomed by his birth and education? It is a knowledge of such circumstances, which makes the biography of the early years of self-taught and extraordinary genius always interesting; and it is this which gives real value to les Confessions. It must be regretted, however, that those to whom the manuscript was intrusted should have published it in his lifetime, and also that they did not suppress certain parts that ought not, at any time, to have been presented to the public gaze. But with all its faults, I cannot avoid agreeing with a French gentleman, whom we met at les Charmettes, who said, "On condamnera toujours les Confessions, mais on ne cessera jamais de les lire."

The evening was so beautiful, and the

air so balmy and delightful, that we sent back our char, and lingered about the Charmettes, till it was late. We then returned over the hill, by the foot-path behind the house, which was Rousseau's morning walk, and entered with regret the gloomy and crowded city of Chamberry.

CHAP. V.

NEW GALLERY OF LES ECHELLES. — STRUCTURE OF VALLEYS. — GEOLOGICAL FACTS. — FORMATION OF MOUNTAIN VALLEYS. — FALL OF PART OF MONT GRENIER. — OBSERVATIONS ON THAT EVENT. — EXTENT OF THE RUINS. — LES ABYMES DE MYANS.

THE new gallery, or passage of les Echelles, on the road from Chamberry to Lyons, formed by the order of Napoleon, was completed in 1810, but the road through it was only opened for carriages eighteen months before we were at Chamberry. This gallery is more striking than any single gallery on the Semplon road, and the valley beyond it well deserves the attention of the geologist; but travellers to or from Italy, seldom stop to examine the immediate objects on the northern side of the Alps. The distance from Chamberry to the new gallery is about fifteen miles. The country, for at least two leagues, is rich and beautiful, the road passing along the valley of the Yere. About four miles from Chamberry the

valley on the left side of the road was scattered over with immense blocks of white limestone; some masses which were *in situ*, presented a variety of fantastic shapes, resembling at a distance colossal statues, others were pyramidal, like the rocks in Dovedale. They seemed the ruins of a mountain that had been shattered in pieces on the spot.

Beyond these ruins there is a magnificent cascade, called the Cascade de Cour. The water falls in one unbroken stream from a great height; it is the same cascade which Rousseau describes as having seen on his first coming to Lyons, and which made so lasting an impression on his mind.

About ten miles from Chamberry, the road passes over a handsome stone bridge, resting on a rock of sandstone; the upper part of the rock is distinctly stratified, dipping to the river, but the strata are singularly intersected at an acute angle, by very regular cleavages, which might be mistaken for stratification, were not the strata here well defined and accessible.

After crossing the bridge, the road turns suddenly, and is carried westward along a deep ravine for several miles, called la Defile

de la Grotte. The limestone rocks now overhang both sides of the road. Just before entering this ravine, I observed the limestone strata on the left were perpendicular. The limestone here is subcrystalline, and extremely hard, but it is as much shattered as some of the chalk rocks in Kent. The road, after continuing a few miles between rocks of limestone, through which it appears to have been cut, is suddenly closed by a natural wall of rock, at least 800 feet in height, which seems to bar all farther progress. It is through this rock that an archway has been perforated, 27 feet in breadth, as many in height, and 960 feet in length. We were five minutes in passing through it, but instead of the bare and rocky ravine we had just left, a rich extended vale, surrounded by magnificent mountains, burst in an instant on our view, as if by enchantment.

The galleries cut through the rocks on the Semplon route produce no surprise, for, before entering them, you discover what the scene will be when you are passed through, but the traveller who arrives at the passage of les Echelles from Chamberry, sees nothing on his approach but barren

precipices, that seem the confines of the habitable world; when, after a few minutes of gloomy twilight, villages, churches, cornfields, vineyards, and forests, are all before him, bounded by a range of mountains, whose sides are covered with verdure, though their summits are capped with perpendicular walls and turrets of limestone of amazing height. On the farthest of these mountains, the monastery of the Grand Chartreuse is situated, but it cannot be seen from the road. The western opening of the passage is considerably above the bottom of the valley, and we descended gradually for two miles before we arrived at les Echelles, a frontier town on the borders of Savoy, where we dined. On our return, I examined the passage and the rocks with more attention. The gallery, or archway, is cut through a very indurated limestone, susceptible of a high polish; it was perforated by blasting. Both ends were opened at the same time, and the labour was continued by different relays of men, working day and night for three years, until the excavations on each side were united. Near the entrance of the passage I met with a very intelligent man, superin-

tending the repairs of the road. He had worked at the gallery, and he informed me that when the excavations from each end nearly met, and the thin partition of rock between them was first broken through by the stroke of the pick, a deep and loud explosion followed, resembling thunder. The cause of this explosion is easily explained. The air on the eastern side of the mountain, or rather wall of rock, through which the passage is cut, must frequently be many degrees colder, and of course denser than that on the western side, as it is sheltered both in the south and west from the sun's rays in the afternoon. The mountain rises full one thousand feet above the passage, and at least fifteen hundred feet above the bottom of the valley, forming a partition between the hot air of the valley and the cool air in the ravine, or *Cul de Sac*, on the eastern side. Now a sudden opening being made for the dense air to rush into a rarer medium, must necessarily produce a loud report, on the same principle as a report is made by the bursting of a bladder in the receiver of an air pump, when the air that surrounds it is rarified. The sound of the explosion would be greatly increased by

reverberation through the long archway on each side.

The rock is so firm that the archway appears to be in no danger of injury from any natural cause, less powerful than an earthquake: it will long remain a monument of the genius of Napoleon. Travellers who visit the passage of les Echelles for the scenery, should approach it from Chamberry, and not from the western or Lyons side. On the one side you emerge from the earth to behold a sudden vision of glory; on the other you leave a splendid valley to plunge into a cave, that opens only on barren rocks. I have mentioned that the rock through which the perforation is made, appears to bar all farther access, and the inhabitants of this valley and the adjoining parts of Dauphiny had, in early ages, no direct natural communication with the other parts of Savoy. On the left, or south side of the ravine, just before you arrive at the gallery, there is a deep fissure between the rocks, which extends for half a league, and turns round towards the valley. Formerly persons on foot were accustomed to pass along this fissure, till they came to a natural cavern,

or series of caverns, which lead to an aperture looking into the valley, and a communication was formed with it by steps and ladders, made for the purpose of descending from this opening down the perpendicular face of rock into the valley; hence the road obtained its name, *le Passage de la Grotte*, and *les Echelles*. A zig-zag road for mules was afterwards cut in the rocks, so as to join the natural fissure, and this remained till 1670, when Charles Emanuel the Second, undertook to make a wider road along the bottom of the fissure, and by a series of terraces, rising from the valley, a practicable descent was formed for all kinds of wheel-carriages. This road, till the time of Napoleon, was considered a miracle of art, though it was far from affording an easy communication between Chamberry and France, for a voiture with four horses was obliged to hire eight oxen, from the village below, to ascend. This village, situated in the valley, at the bottom of the road, is called le Village de la Roche. The pompous inscription placed upon the rock, and written by the Abbé Real, on the completion of the old road, would have some truth, if applied

to the new road formed by Napoleon, but it seems utterly ridiculous where it is, by forcing upon the attention a comparison between the two undertakings.

Carolus Emanuel II.
Subaudiæ Dux. Piedmontis Princeps, Cypri Rex,
Publica felicitate parta, singulorum commodis intentus,
Breviorem, securiorem, viam regiam,
A Natura occlusam, Romanis intentatam,
Cæteris desperatam, dejectis scopulorum repagulis,
Æquata montium iniquitate
Quæ cervicibus imminebant, præcipita pedibus substernens,
Æternis populorum commerciis patefacit
Anno Domini MDCLXX.

The physical structure of the valley of les Echelles is very remarkable. Its excavation cannot be explained by the erosion of currents of waters running through it. The bottom of the valley is of a semi-elliptical shape. There is no river, nor any thing deserving the name of a rivulet, running along it. The river Guiers, rising in the mountains of the Grand Chartreuse, crosses the bottom of the valley, transversely, at about three miles distance from the upper end. Standing at the town of les Echelles, and looking eastward up the valley, you have, on the south side, a range

of mountains, capped with strata of limestone, forming mural precipices, one thousand feet in height, which cover steep and verdant slopes, formed of softer strata, and much furrowed; these slopes decline rapidly to the valley, and rest on other strata of limestone, near the bottom of it. On the north, mountains of less elevation decline gradually into the valley, and in front, instead of a narrow ravine, which commonly terminates the upper end of valleys, we have here a wall of limestone rock, a mile in length, stretching across the valley from one side to the other, and closing it up. There are, it is true, mountains of higher elevation beyond this wall, and it might have been supposed that the waters descending from thence had once passed over it in a mighty cataract, which had excavated the present valley; but this is impossible, as the wall is detached from the mountains behind it, and is not much more than 1000 feet wide: hence it is evident that the waters descending from these mountains passed off in a different direction, and could not have effected the excavation of the valley. At Malham Cove, near Settle, in Yorkshire, we have

an instance of a broad perpendicular escarpement of limestone rock, closing a small glen. The river Air rises at the bottom of this rock, and runs along the glen; but above the rock there is a mountain lake and plain. The river Air probably flowed over this rock, before the glen was excavated, as in rainy seasons there is still a stream of water falling over it; here there might be no difficulty in admitting that the glen had been excavated by a water-fall, but such a supposition is utterly inadmissible in the valley of *les Echelles*.

In order to form a correct idea of the structure of the valleys in this part of Savoy, it will be necessary to become acquainted with its geology, which has hitherto been little noticed or understood; I shall, therefore, devote the remaining part of the chapter to a statement of my own observations, and the inferences to be drawn from them. It was the prevailing opinion of Saussure, that the calcareous mountains of Savoy were among nearly the most ancient of calcareous formations, or what the Wernerians have since denominated transition limestones. So fully was he pre-

possessed with the truth of this opinion, that he seems to doubt the evidence of his senses, when contrary facts sometimes obtruded themselves on his notice. Thus he was greatly surprised to observe sandstone at Albi, near the Lake of Annecy, in a position nearly vertical; and the sandstone at Bonneville, though it is regularly interstratified with the limestone, he regarded as out of its true position. He was disposed to draw this conclusion, because it was then thought that sandstone was of mechanical and recent formation. The opinions of Saussure have prevailed to our own times; and Dr. Berger, in an early number of the Geological Transactions, speaks of the limestone of Mellierie, as affording a true type of transition-limestone. The attention of Saussure was almost exclusively directed to that class of rocks which are called primary; and it is not surprising that he should have fallen into some errors respecting the upper strata, for at the period when he made his observations little was known respecting them, nor were they, indeed, thought deserving of so much attention as at present. I regard Saussure as the most intelligent, as well as the most

candid of all geological observers in the last century: he scarcely ever suffered his judgment to be warped by an attachment to theory, on those subjects to which his attention was mainly directed. I have said that the upper secondary strata scarcely attracted his attention, otherwise he would have found that the upper calcareous mountains, on the western side of Savoy, all rest upon an immense formation of sandstone, and are interstratified with it; and so far from sandstone being more recent than the limestone, or of extraordinary occurrence, it constitutes a considerable portion of those mountains which are called calcareous. It is this which gives to the mountains in the Bauges, and in the neighbourhood of Annecy and Chamberry, their peculiar external form and character: it is this which has determined the form and extent of many of the valleys; and it is this which offers a kind of key to the physical structure of the outer range of the Alps. The general appearance of the mountains in the part of Savoy I have been describing, is that of immense walls or ridges of limestone, supported on very steep slopes, which are frequently deeply

furrowed; but, except in these furrows, the slopes are covered with verdure.

The delineations of the mountains on the Lake of Annecy, and of the Dent D'Alençon, (Plate II.) and of Mont Grenier, will convey a tolerably correct idea of their general form. Even before I had an opportunity of examining these mountains closely, I was convinced that their slopes were not the debris of the upper limestone strata, but were formed by the under strata, which were much softer, and on which the limestone immediately rested. In proportion as these soft strata have been washed away from the base of the limestone, they have left it unsupported, and at length have produced those fatal eboulements so frequent in this part of Savoy; eboulements which could not take place to the great extent they do, if the whole of the mountains were limestone.

At the valley of les Echelles, the immediate junction of the limestone with the sandstone may be seen soon after entering the valley from the archway. This vast wall of limestone, nearly 1000 feet in thickness, rests upon a mass of sandstone of unknown depth: there is

very little dip where the first junction is seen; but about a mile below, you meet with the limestone again in junction with the sandstone, and thrown into a vertical position. The workmen that I met with near the mouth of the gallery, said they always found sandstone below the limestone, and they considered it as the lowest bed in the country; but this is obviously a mistake. The sandstone or molasse on which the limestone on this part of Savoy reposes, or which is subordinate to the limestone, is composed of smallish grains of quartz and chlorite, pretty equally mixed. In the sandstone of les Echelles, which I got from its junction with the limestone, there were some particles of rose-quartz and mica. It scratched glass strongly when rubbed upon it; but when put into dilute muriatic acid, it effervesced violently, and became friable, owing to the solution of the calcareous cement, by which it appears, from this experiment, to be agglutinated. The molasse, which is interstratified with limestone, and associated with coal on the Lake of Annecy, also effervesced; but the particles being smaller, it appeared nearly homogeneous when examined without a

lens. It has been recently stated that the molasse of the Alps belongs to the same formation as the sandstone above chalk near Paris. There may be sandstone of that formation in the canton of Berne; but the molasse or sandstone in this part of Savoy, I am well convinced, is a member of formations that are lower than chalk. It is possible, however, that beds of this molasse may have been worn down, during the great destruction of the strata that has evidently taken place since they were deposited, and from the debris of this sandstone, upper beds may have been formed covering strata that are above chalk. The molasse which covers the bones and teeth of the mastodon and other large mammalia, near Alpnach, nearly resembles that in this part of Savoy; but the particles are smaller and more intimately mixed.

The great wall of limestone through which the gallery is cut, was once joined to the mountain behind it, though it is at present separated from it by a deep chasm, at the bottom of which the old road is carried. This was apparent in walking down this road, for I observed the strata-seams in the rocks on each side, to correspond.

The strata of sandstone and limestone in the valley going to the town of Echelles must have undergone a great disturbance, as is proved by their occurrence in a vertical position at the lower end of the valley, though they are nearly horizontal at the upper end. Hence I should be inclined to believe, that this extraordinary valley was formed by a subsidency of the ground.

The masses of limestone that form the castellated summits of the mountains in this part of Savoy, range generally from 3000 to 4500 feet above the level of the valleys, and are all probably parts of one vast stratum, that once was continuous; but this can only be determined by an actual examination, which, in many instances, would be difficult to make. The calcareous strata here, have not the same regularity of dip over a considerable extent, as the upper calcareous strata in England, but they very frequently dip in opposite directions on the opposite sides of the same mountain, and are nearly flat on the top; and as the dip on each side is often very considerable, to this cause we may attribute the occurrence of caps of limestone remaining on the tops of the mountains, when the strata on the

sides of the mountains have nearly or entirely disappeared. Where the dip is less considerable, they remain unbroken, forming what the Wernerians call a mantle-shaped stratification; which, however, is always more or less broken. Now, it is evident that those strata of limestone which contain marine organic remains, were formed under the waters of the ocean, and their original position must have been nearly horizontal; at least, it is impossible they could have been deposited at an angle of sixty or seventy degrees, or nearly vertical; in which positions they very frequently occur in this part of the Alps. It is equally obvious, that strata of sandstone, or sandstone intermixed with rounded bolders, could not have been originally deposited at angles exceeding forty-five degrees, or nearly vertical; in which position they are also found extending from the bottom to the top of a mountain, and preserving nearly the same thickness throughout their whole extent. In such instances, and they are of frequent occurrence, we must admit that the strata have changed their original position, and have been elevated either by a subsidency of one part of the strata, or by the action of

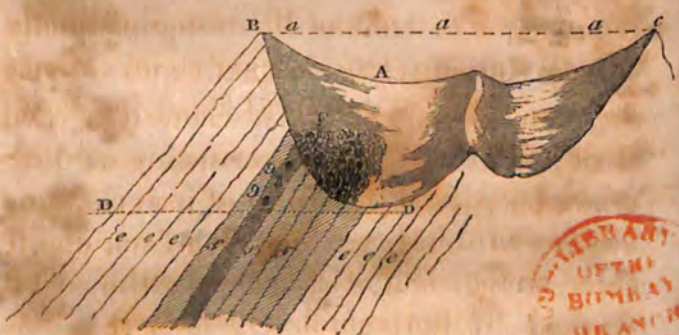
some power from beneath, upheaving the whole mass with a force which was most intense, near the present centre of the mountain. The latter appears the more probable supposition, in all those cases where the strata dip in opposite directions on the opposite sides of a mountain, and are nearly flat at the top. To this breaking up of the strata, when the mountains were first raised, and to diluvial currents which have in remote periods passed over them, I am persuaded, we must resort to explain their present appearance in this part of Savoy. Water-courses, or atmospheric agency, however considerable their effects in the course of ages, appear altogether inadequate to occasion the changes the strata have obviously undergone; at least it will be admitted that no atmospheric action could bend strata of vast thickness into deep curves, or change their position from horizontal to vertical.

Whether the caps of limestone on the summits of the mountains in this part of Savoy are all parts of one vast bed, or of different beds, I will not pretend to determine, as there is more than one considerable bed of sandstone interstratified with this lime-

stone, and the mineralogical characters of the upper and lower beds of limestone are frequently so similar, that they are not to be distinguished.

While we were at Château Duing, I visited a coal mine near the Lake of Annecy, called the Mine of Entreveines. It is situated in a calcareous mountain; and as the structure of this mountain may serve to explain the general structure of the mountains in Savoy, I reserved the description of it for that purpose. The mountain in which the mine is situated, is part of the western range that borders the upper end of the Lake of Annecy. One fine morning in June we set off at six o'clock to visit this mine. At the head of the lake, the road turned off to the right till we came to a village called La Thuille, where we hired a waggon and two stout horses, with a driver on foot, the road being extremely dangerous, particularly in descending. Common chars are not sufficiently strong for the purpose. Above La Thuille, there is an opening or rather an indentation in the mountain, through which an alpine zigzag road has been made to the coal mine. The limestone of this mountain is extremely

hard, and is in some parts nearly white, in others veined with red, evidently coloured by oxid of iron, ferruginous water percolating through its fissures. I observed that the limestone alternated with sandstone (molasse), but the road did not admit of my ascertaining the thickness of the latter. When we had ascended for about an hour and a half, we found ourselves in a mountain-valley between two ranges of limestone rocks declining north to the middle of the Lake of Annecy. The annexed section represents the position of the coal-strata imbedded in the calcareous mountains.



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There is a rivulet which cuts the strata nearly at right-angles, and would have afforded an excellent section of the strata on

each side of the coal, were it not for a quantity of rubbish from the mine, which has been thrown into it. But to make the description intelligible, I must refer to the section plate: — A, upper part of a mountain valley, more than 2000 feet above the lake, and sloping down to it: and B and *c*, the mountains which bound the eastern and western side of the mountain-valley; these should be considered as parts of the same mountain, in which a longitudinal grove or valley had been excavated: D D, is a brook running transversely across the eastern side of the valley, intersecting the strata nearly at right-angles, and descending down the opening along which the road to the mine is made: *e e*, strata of limestone distinctly visible, dipping at an angle of about seventy degrees: *f* to *f*, strata of sandstone and shale, with a bed of coal consisting of three seams; separated by seams of iron clay, and varying in thickness, affording from one to three or four feet of good coal; the coal is worked by horizontal galleries, *g g*, one over the other, as if it were a perpendicular vein.

Unfortunately the mine was not working

the day we were there, and I could only proceed a short distance into it. The position of the coal being nearly vertical, it can scarcely be said to have a roof; but on the eastern side, which we will call the top, there is a thickish bed of imperfect coal, or rather bituminous schist, over the true coal, which yields a flame when exposed to heat, though it will not burn by itself. There is a bed of tender sandstone (molasse), and a bed of light grey earthy limestone over the coal; and also a bed of dark earthy limestone, containing bivalve and univalve shells, which I believe forms the roof to the imperfect coal before mentioned. The univalve shells were shattered and compressed. I was not so fortunate as to procure specimens, but a friend of mine obtained some, which resembled cerithia, they were imperfect. The bivalves bear a resemblance to cytherea, but neither M. Brogniart at Paris, nor Mr. Webster in London, to whom I showed them, were able to decide to what genus they belonged. Between the coal there are thin seams of black calcareous schist, intermixed with very thin laminæ of shining coal. The

coal is situated nearer to the limestone which forms the eastern side of the mountain, than to that on the western side: from the latter it is separated by numerous beds of sandstone, which, from the colour of the water that issues from them, appear to contain much iron. The thickness of the sandstone-strata containing coal may be 150 yards. I paced over it, and saw its junction both with the upper and lower limestone, but I omitted to note down the distance. The upper limestone is highly indurated, and nearly white: it is translucent at the edges, and possesses the mineralogical character of a primitive limestone; but it covers strata containing shells that in England are peculiar to the upper calcareous formations: and in other situations in Savoy, I have seen similar limestone alternating with strata analogous to our green sand, and containing similar fossils. Some of the beds of this limestone were striped with red veins, the colour of which proceeded from an infiltration of water, impregnated with iron. The lower limestone differs in colour from the upper, being grey. The direction of the strata is S.S.E. and N.N.W., as I ascertained with a compass;

but about 500 yards further north than the present mine, the strata bend to the east. The men who work in the mine, told me that the coal is continued to the bottom of the valley, and crosses the Lake of Annecy in a direction toward Château Menthon, which is not improbable. I found in the same range as the mine a similar sandstone to what accompanies the coal, about six miles lower down, near the lake. The coal of Entreveines is worked at the height of 3500 feet above the level of the sea.

I suppose some of my readers have already determined this coal of Entreveines to be anthracite, from its occurrence in the Alps; if so, they are greatly mistaken. The coal is black and shining: it breaks into acute-angled fragments, and does not soil the fingers. It is so highly bituminous that it is at present used exclusively for gas lights at the cotton-mills in Annecy; but as it is not sufficiently powerful to be used by the smiths, its consumption is very limited, perhaps owing to the difficulty of access to the mine. This coal, though it has all the characters of a highly bituminous mineral coal, is associated with strata containing those shells that only occur in

the upper calcareous strata in England, far above the regular coal-formation; hence I am inclined to believe its position should be referred to that of the coal found among oolite in the eastern moorlands of Yorkshire, but its quality is greatly superior to the latter. The limestone of the mountain where the mine is situated, affords no mineral character to decide to what formation it belongs; for in this part of Savoy, strata of limestone that contain the fossils of an upper calcareous formation, occur so highly indurated and crystalline, that they resemble what we have hitherto regarded as the most perfect of transition-limestones. Some of the strata are nearly white, approaching to statuary marble; yet I doubt whether these are of posterior formation to our lower beds of chalk. At least I found in the subjacent argillaceous strata the *gryphæa arcuata* in abundance, and also casts of belemnites; which, if we are to take fossil remains for our guide, would refer the strata in which they are found, either to the lias or the clunch-clay of the English series. But it is deserving of particular notice, that when we leave France, and pass the range of the Jura, the similarity of external character

is generally lost between the English strata and those of Savoy, though a very great number of our English fossils, have their analogues in this part of the Alps. I do not think the inference to be drawn from similarity of organic remains in the strata in distant parts of the globe, can generally be extended so far as many geologists suppose, yet I am persuaded that the fossil-shells in the mountains near Annecy, prove that they must be considered as belonging to formations considerably above the coal formations in England.

I now wish to direct the attention of geologists to the singular fact of thick beds of soft sandstone occurring in a nearly vertical position among strata of highly indurated limestone, as I am inclined to believe that it will satisfactorily explain the formation of this valley where the coal-mine is situated, and of many other mountain-valleys in Savoy.

To render this intelligible, let us suppose the valley at the coal-mine to be filled up by prolonging the edges of the strata to the dotted lines *a a;* this will represent the strata when they were first elevated. (See page 186.) Now if we suppose currents

of water to pass over the basset edges of the strata, the sandstone, being soft, would be excavated far more rapidly than the limestone on each side of it, and thus a deep trough would be formed, and portions of the upper strata of limestone, for want of the support of the sandstone strata, would break down and widen the valley. Such appears clearly to have been the case, for the debris from the limestone-strata has formed a talus or slope. (See page 186.) A mountain that ranges on the western side of the lake of Annecy, and which terminates near the city of Annecy, when seen in profile, offers a good illustration of valleys formed in this manner on a small scale. Several longitudinal valleys run parallel to each other, from the top of the mountain, which have evidently been excavated in the edges of soft strata that occur in the limestone, and dip at a very acute angle. At the coal-mine, the vertical position of the soft strata, containing coal and marine organic remains, could not possibly have been their original one; nor have these strata been dislocated by a partial fault, as they are conformable to the position of the other strata in a mountain which is about nine

miles in length and two in breadth. By whatever cause they have been raised, it must be obvious that at the period of their elevation, the present mountain-valley was not excavated. We have not here to enquire whether the waters that scooped out these valleys, were those of a mighty deluge that swept almost instantaneously over the globe with an immense force, or whether the valleys were gradually excavated by rivers running along them, though the latter hypothesis seems scarcely adequate to the effect, as the heads of the valleys are low, compared with the mountains by which they are bounded. But whether the waters were diluvial or fluviatile, we cannot doubt that it was by their agency that the beds of soft sandstone have been washed away.

I am not aware that any geologist has hitherto adverted to the alternation of hard and soft strata, as offering an explanation of the formation of these mountain-valleys. To me it appears satisfactory. I am far, however, from believing, that all valleys were formed by the excavation of soft strata; many of the valleys in this part of the Alps appear most evidently to have been formed by a violent derangement of

the strata, which has elevated them in one part and depressed them in another; but I must refer the reader to another part of this work, for the further consideration of this subject.

The formation of many of the cols or depressions in the ranges of the higher Alps admit of a similar explanation; but of these I shall elsewhere speak.

What has been said of the structure of the mountains, in this part of Savoy, may serve to explain the cause of those great eboulements that sometimes occur. I shall, therefore, proceed to describe the present appearance of Mont Grenier, about five miles south of Chamberry, which we visited the day after our journey to les Echelles. A part of this mountain fell down in the year 1248, and entirely buried five parishes, and the town and church of St. André. The ruins spread over an extent of about nine square miles, and are called *les Abymes de Myans*. After a lapse of so many centuries, they still present a singular scene of desolation. The catastrophe must have been most awful when seen from the vicinity; for Mont Grenier is almost isolated, advancing into a broad

plain, which extends to the valley of the Isere. It is several miles in length, and is connected with the mountains of the Grand Chartreux; but it is very narrow. Its longitudinal direction is from east to west: near the middle it makes a bend towards the north, forming a kind of bay or concavity on the southern side; and there is a corresponding convexity or projection on the northern side. It has been generally believed, that the part of the mountain which fell down was from the middle, and that the eboulement formed the concavity on the southern side; but this opinion appears to me erroneous, as the direction of the ruins, and the form of the mountain, indicate that it was the south-eastern side which fell.

Mont Grenier rises very abruptly upwards of 4000 feet above the plain. Like the mountains of les Echelles, with which it is connected, it is capped with an immense mass of limestone strata, not less than 600 feet in thickness, which presents, on every side, the appearance of a wall. The strata dip gently to the side which fell into the plain. This mass of limestone rests on a foundation of softer strata, probably molasse; but I could only examine it

with my telescope from below. Under this molasse are distinctly seen thin strata, probably of limestone, alternating with soft strata. The annexed cut represents the east wing of the mountain, and a small part of the Abymes de Myans. There can be little doubt that the catastrophe was caused by the gradual erosion of the soft strata, which undermined the mass of limestone above, and projected it into the plain; it is also probable, that the part which fell, had for some time, been nearly detached from the mountain by a shrinking of the southern side, as there is at present a rent at this end, upwards of 2000 feet deep, which seems to have cut off a large section from the eastern end, that now

"Hangs in doubtful ruins o'er its base,"

as if prepared to renew the catastrophe of 1248.

The Abymes de Myans are hills, or rather monticules of a conical shape, varying in height from twenty to thirty feet; they cover about nine square miles. Each of these monticules may be considered as a detached heap of ruins, composed of fragments of calcareous strata, some of which

are of immense size. They have been projected to the distance of three and four miles from the mountain. The largest masses have evidently fallen from the upper bed of limestone, by which Mont Grenier is capped. The velocity they would acquire, by falling from so great a height, making due allowance for the resistance of the atmosphere, could not be less than 300 feet per second; and the projectile force they gained by striking against the base of the mountain, or against each other, has spread them far into the plain. In the course of years the rains, or currents of water from dissolving snows, have furrowed channels between the larger masses of stone, and, washing away part of the loose earth, have left the immense number of detached conical hills which are seen at present. The monticules are all composed of nearly the same kind of limestone; and do not contain any fragments of granite, or primary rocks from more distant parts of the Alps: this would prove, were any proof wanting, that the stones have fallen from the neighbouring mountain. The devastation stopped a little short of the church at Myans, dedicated to the Virgin, called *Notre Dame de Myans;* hence that

church acquired great celebrity: but it may be seen that the elevation of the ground assisted the efforts of the Virgin in arresting the calamity. St. Andrew could obtain no favour for his church or town, though it was one of great note in those days, being the ancient seat of the deanery of Savoy. Pilgrimages are now made to the church of *Notre Dame de Myans;* and, on the day of the festival of the Virgin, her shrine is visited by several thousand persons from distant parts of Savoy.

So deep and vast was the mass of ruins that covered the town of St. André, and the other parishes, that nothing belonging to them has been discovered, except a small bronze statue of a woman, with the inscription —

"STEPHS. LAGHERP ME FECIT."

It was so wretchedly executed, that the peasant who found it supposed it was an image of the devil, and carried it in great trepidation to his curé.

Notwithstanding a great part of the Abymes de Myans is planted with vines, they still present a most impressive scene of wide-spreading ruin, far exceeding in magnitude any of the eboulements that I

saw elsewhere in Switzerland or Savoy. The ancient chronicles which preserved the record of this event, do not inform us whether the fall of the mountain was preceded by any forewarnings, that allowed the inhabitants time to make their escape. To form some idea of the quantity of matter that fell, if we calculate only what covered the part now called les Abymes de Myans, the average depth of which cannot be estimated at less than six yards, spread over an extent of nearly nine square miles, this would amount to upwards of one hundred and fifty million cubic yards; and we may suppose an equal quantity of earth and smaller stones to have fallen near the foot of the mountain; these, together, would be more than four hundred million tons in weight. Such an immense quantity of matter, precipitated from the height of three quarters of a mile into the plain, must have produced a shock, inconceivably vast and awful.

The rocks which fell from Mont Grenier I found to consist of a yellowish limestone, which was oölitic, strongly resembling the lower oölites in Gloucestershire; a grey limestone, harder and more crystalline than

lias, which, however, it may probably be; and a thin slaty arenaceous limestone, very much resembling the Stonesfield slate, on the surface of which I observed the remaining nacre of a shell, but I did not find any perfect shells. There were also fragments of a schistose chert, interstratified with some of the limestone. On referring to Saussure, who has mentioned the Abymes de Myans, (*Voyages dans les Alpes*, vol. iii.) he says that he discovered shells in the limestone, but he does not state of what species. Fortunately the character of the limestone of Mont Grenier may, in some degree, supply the place of fossil remains, in determining to what formation it belongs, as it bears a stronger resemblance to well known British strata, than any other limestone I examined in Savoy.

As Mont Grenier is a part of the same range which extends to les Echelles on one side, and to Aix on the other, its geology, when once ascertained, will suffice for most of the calcareous mountains in this part of Savoy.

From the Abymes de Myans, looking towards Montmelian, the mountain called La Tuille, over that town, may be observed

to great advantage. When seen at this distance, and in their just proportions, the apparent contortions of the strata which so greatly surprized Saussure, (*Voyages dans les Alpes*, vol. iii.) and which he regarded as inexplicable, are resolvable into one of the cases of irregular sections made in a curved stratification, which will be described in the Appendix.

The roads that wind among the Abymes de Myans are so narrow and intricate, that we lost our way and entered the frontiers of France; of which we were apprized by the custom-house officers, who suffered us, however, to return without examination on explaining our mistake. We arrived at Montmelian at four o'clock, having left Chamberry at eight. By the high road it is only a two-hours' drive.

The ruggedness of the road among the Abymes de Myans had greatly fatigued our horse, which obliged us to remain at Montmelian till near sunset, and we did not arrive at L'Hopital before midnight. I did not then know that there is a tolerable inn, La Croix Rouge, at St. Pierre, half way between Montmelian and L'Hopital, where we might have slept.

CHAP. VI.

THE TARENTAISE. — VALLEY OF THE ISERE. — OBSERVATIONS ON THE PASSAGE OF HANNIBAL. — MOUTIERS. — SALT WORKS AND SALT SPRINGS. — EVAPORATION BY FAGGOTS. — MINES. — BOURG ST. MAURICE. — THE LITTLE ST. BERNARD.

After crossing the Isere at L'Hopital, we passed under the town of Conflans, which, placed on a rock of mica slate, towers over the road. Turning south, we soon entered the upper valley of the Isere. This river rises from the glaciers of Mont Iseran, in the Grecian Alps, from whence it descends to the foot of the Little St. Bernard, and to Bourg St. Maurice and Moutiers; and then running to the north-west, it unites with the Arly in the great valley of Savoy, below Conflans.

It is the upper valley of the Isere, with the lateral valleys that open into it, that comprise the ancient province of the Tarentaise; so named from the city called by Ptolemy and Strabo Darentasia, the me-

tropolis of the Grecian and Pennine Alps, and afterwards the seat of one of the most ancient bishoprics in Europe. The mountains that form the western boundary of the Tarentaise, separate this province from the valley of the Maurienne, which extends from Aguebelle near the Lower Isere, to Mont Cenis. The mountains on the east divide it from the district of Beaufort, and join the central chain of the Alps at the Col de Bon Homme, and the Little St. Bernard. Soon after entering the valley of the Upper Isere, the road seems to wind in a labyrinth among impassable mountains, having the river on the right, which forces its passage impetuously among the rocks, — black and turbid as the fabled Acheron, from the particles of dark schist which it carries down in its course; for after passing Conflans, the mica slate is succeeded by dark slate, *schiste ardoise.* There are extensive quarries of roofing slate near the road. Not far from the entrance of the valley, we saw a man descending from the woods, the most perfect picture of a savage I ever beheld: he was nearly naked, his skin of a dark copper colour, his hair black and matted, his beard shaggy and grisly, and

the expression of his countenance in keeping with his general appearance; he was, indeed, one of the "*homines intonsi et unculti*," such as Livy describes in this part of the Alps. To what cast of society he belonged I could not learn, as our voiturier was a stranger to the country. We saw no one resembling him in any part of Savoy. Certainly, when Hannibal passed up this valley, none of the native inhabitants could have appeared further removed from civilised life. The mountains that immediately bound the upper valley of the Isere seldom rise so high as to reach the line of perpetual snow: their sides, to a considerable height, are covered with forests, among which pinnacles of rock rise out, bare and threatening. In the deep gorges on each side of the valley, many an impetuous cataract bounds from precipice to precipice, till it reaches the Isere: two of these are of vast magnitude, and would be thought worth a day's journey to see, in countries remote from the Alps. In the whole of this valley, particularly in the higher part, there is an air of gloomy grandeur, and a sombre imposing solemnity, that I have never observed elsewhere: the blackness

of the river and the occasional deep roarings of the numerous waterfalls, greatly heighten the effect. The poet might most truly say—

> " Here Melancholy sits, and round her throws
> A deathlike silence and a dread repose;
> Deepens the murmur of the falling floods,
> And spreads a browner horror o'er the woods."

The genius of Salvator could not imagine finer subjects for the pencil than the wild and awful scenery which presents itself on each side as you advance, sometimes rendered more interesting by a lofty castle in ruins, or by mountain villages and churches.

Of the castles — now in ruins, but which once defended the passes on each side the river — no history remains. The wider parts of the valley are well cultivated; and the numerous country-houses we passed, surrounded by vineyards and corn-fields, indicate the prosperity and fertility of this part of Savoy. The houses are the summer abodes of the landed proprietors, who come here during the vintage and harvest, to receive their rents in produce.

In many parts of the valley there is

scarcely sufficient width for the road, but having cleared these passes, the valley opens again, and presents a cultivated country on each side, surrounded by impending mountains, with here and there the remains of vast eboulements, scattered at their feet.

There are also four extraordinary gorges, which seem almost impassable with an army, if any determined resistance were made. These gorges are formed by the rocks advancing on each side, and compelling the river to pass between them, through a narrow chasm several hundred feet in length. The road is either cut out of the rock by the side of the precipice, or is carried over it at a distance from the river. One of these gorges occurs on this side of Moutiers, and the others are between Moutiers and the foot of the Little St. Bernard. The longest is called the Virgin's-leap (*la Saute de Pucelle*). The rocks near and beyond Moutiers are calcareous; and these calcareous rocks form the narrow gorges which thus close up the valley.

In the work which my friend, Mr. Andrew de Luc, of Geneva, has published on the route of the Carthaginian general, he has made it appear highly probable, that

Hannibal passed with his army into Italy by the upper valley of the Isere, and the Little St. Bernard. Nothing but an actual inspection of the route, can give an adequate idea of the difficulties he must have had to encounter when he entered this defile, which is forty miles in length, and defended by many formidable passes, where a few men, placed on the heights above, might have successfully resisted the most powerful armies.

The account given by some historians, of Hannibal's dissolving the rocks by vinegar, in his passage over the Alps, appears so improbable, that it has generally been treated, in modern times, as a fable, undeserving attention. An inspection of the route, however, inclined me to believe that this story, like many ancient fables, was founded on facts that have been perverted by the ignorance of historians. In many of the passes in the valley of the Isere, where the rocks overhang the river on each side, a path carried midway along the side of the precipice might be so obstructed by a projecting mass of stone, as to deny access to oxen or elephants. Now, in such situations, it will be readily ad-

mitted that a small quantity of gunpowder would effect more in a few hours than the labour of men for several days, especially as, from the narrowness of the pass, not more than one or two men could work at the same time. We are unacquainted with the means which the ancients employed in breaking and removing large masses of stone; it is possible that the expansive power of vapour might be one of them. Thus by boring hard calcareous rocks, and filling the cavity with concentrated vinegar, and plugging up the aperture, they might, by the evolution of gas, obtain a similar effect to the explosion of gunpowder, or the expansion of steam; this effect might be farther increased by making a large fire against the rock. Count Rumford ascertained that a dram of water, inclosed in a mass of iron the size of a solid twenty-four pound cannon, was sufficient to burst it, with a tremendous explosion on the application of heat: even the expansion of water by freezing will rend the hardest rocks. It also deserves attention, that most of the calcareous strata in the Alps are intersected by cross seams, evidently the result of crystallization in the mass,

and these seams are often so close as to be nearly imperceptible, and quite impervious to air or water. By taking advantage of such seams, and making the borings in them, a small degree of expansive force would rend large masses of rock, as they split with great facility along the cross seams, which are the natural cleavages, and are nearly as regular as those of a rhomboidal crystal of calcspar.

I am inclined to believe that Hannibal, whose mind was so fertile in resources, might be acquainted with the power of compressed vapour, or gas, in bursting masses of stone, and that he employed vinegar, not as a chemical agent to dissolve the projecting masses of rock that obstructed his progress, but to act mechanically in rending them, either by the evolution of gas, by the expansion of vapour, or by the force of both these agents conjointly. It is indeed difficult to conceive how such a story as that of dissolving the Alps with vinegar, could have originated without some foundation in fact; but facts, imperfectly understood, have not unfrequently been transformed by historians into prodigies, which have maintained credit for ages,

and at length are rejected as fabulous, until circumstances are discovered which elucidate the obscurity of history, and enable us to separate truth from error.*

* At the place where the above remarks were written, I had no opportunity of consulting Livy: on a reference to that historian, I find that he informs us Hannibal employed vinegar to open a passage on his descent into Italy, soon after he had crossed the summit of the Alps; but the whole narration of this remarkable expedition, as given by the Roman historian, though replete with poetical imagery, is destitute of all the features of individual locality, which might serve to point out the line of route to future travellers. On this account he is not to be compared with Polybius, who wrote at a period much nearer the time of Hannibal's expedition, and who had travelled over the whole route himself. Livy thus describes the rock, and the mode of dissolving it: "Ventum deinde ad multo angustiorem rupem; atque ita rectis saxis ut ægre expeditus milites tentabundus, manibusque retinens virgulta ac stripes circa eminentes demittere sese posset. Natura locus jam ante præceps, recenti lapsu terræ, in pedum mille admodum altitudinem abruptus erat. Ibi quum velut ad finem viæ equites constitissent, miranti Annibali quæ res moraretur agmen nunciatur, rupem inviam esse." "Inde ad rupem muniendum, perquam unam via esse poterat, milites ducti quum cædendum esset saxum, arboribus circa immanibus dejectis detruncatisque struem ingentem lignorum faciunt: (quum vis venti apta faciendo igni coorta esset,) camque succendunt, ardentiaque saxa infuso aceto putrefaciunt. Ita torridam incendio rupem ferro pandunt, molliuntque anfractibus modicis clivos,

About two miles before arriving at Moutiers, we passed Aigue Blanche, a neat town, with one principal street. The bottom of the valley is here formed of dark calcareous tuffa, which is quarried for building-stone; it is light and durable. A little beyond Aigue Blanche the rocks advance on each side and close up the valley, leaving only a deep chasm, not many yards wide, through which the river rushes; the road is carried along the side of the precipice, above the river, but is secured by a parapet wall. This is the first of the great gorges I have before mentioned; it may be said to cut off entirely the lower part of the valley from the upper. You might imagine that it formed

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ut non jumenta solum, sed elephanti etiam deduci possent." His. lib. 21.

From the above account it is clear that Livy supposes the rock was decomposed, or softened, by pouring vinegar on its surface, when it had been heated by the burning of an immense pile of wood heaped against it; but it is quite impossible that any quantity of vinegar which the army might have brought with them over the Alps, could be sufficient to effect any great change in the hardness of the rock, when poured upon it, whereas a small quantity, closely confined, might be adequate to rend the whole mass.

the termination of the route, as the river turns suddenly and appears lost. After passing this gorge we descended to Moutiers, situated in a small plain, but surrounded by such precipitous mountains, that a stranger, who should arrive here in the dark, would, the next morning, find it difficult to conjecture by what way he had entered, or how he was to escape.

We arrived at the principal inn about five o'clock. The house was spacious and the dining room handsome; but we were told there was nothing to be had for dinner, as it was fast-day, Friday. On expressing our disappointment, the landlady smiled and shook her head, and looked unutterable things, but scarcely spoke a word. We could not imagine the meaning of this dumb shew; but we found out at last, that though it was a day to fast from flesh, she had not proclaimed a fast from the bottle. Armstrong has said, that when men are under the influence of wine,

> "—— What is difficult and what is dire
> Yields to their prowess and superior might."

It was far otherwise with our hostess, for to her every thing was impossible. At

length, by much persuasion, she agreed to make us a dinner of some kind; it consisted of a miserable cold trout and an omelet. Though Moutiers is the capital of the Tarentaise, there are only two inns in the place for travellers. The fact is, few strangers pass this way into Italy, to encourage improvement in the inns, and the Savoyards are contented with their present accommodations.

This town contains about two thousand inhabitants. Before the French Revolution it was the seat of the archbishop: the last archbishop died there, when the French took possession of Moutiers in 1793. The episcopal palace still remains, but the fine cathedral was destoyed, all but the eastern window. According to the chronicles of Savoy there had been, during thirteen centuries, eighteen bishops of Moutiers, and fifty-seven archbishops. There are some very ancient churches in the town, and a few handsome houses. At what period Moutiers became the capital of the province is not exactly known. The Ostrogoths, in the seventh century, and the Saracens in the ninth, having penetrated into this part of the Alps, so completely

devastated the Tarentaise, and destroyed or put to flight all the inhabitants, that no vestige remains of the ancient Darentasia, nor is the date of its destruction accurately ascertained. Some of the particulars of this desolation are alluded to in the deed of donation, which Rodolphus, the third Duke of Burgundy, made of the Tarentaise to Amazzon, archbishop of the Grecian Alps, in the year 996. The counts of Savoy soon began to interfere with the temporal power of the archbishops, and after Savoy became a dukedom, the sovereignty of the archbishops was finally yielded to the dukes by treaty.

Moutiers is badly supplied with water; the inhabitants are obliged to make use of the water of the Isere, which, by passing over gypsum and limestone, is generally white and turbid. I have before mentioned that in the lower part of the valley, where the river runs over slate, the water is black. We were shown a handsome house, which had been built on an eminence above the town, but which remained uninhabited on account of the difficulty of getting water, as there were no springs. There are two stone bridges at Moutiers over the Isere.

The mountains that surround Moutiers are very precipitous, and subject to eboulements. Two years before we were there, the upper part of a mountain of limestone fell down with a prodigious noise, and its ruins spread across the Isere, and formed a sort of dam over which persons might pass, but in a short time the river forced a passage through. A gentleman told me he was playing at billiards in the town, and thought there had been an earthquake, accompanied with thunder. The noise lasted upwards of a minute. The mountain was nearly perpendicular; this prevented the stones from spreading as far as they would have done, had they struck against a sloping base in their descent. The sides of some of the mountains are covered with pines, but they have been much bared of wood to supply the salt works.

When the French had possession of Savoy the government established a school of mines at Moutiers, for the instruction of young men in mineralogy and metallurgy; a most useful institution, in a country abounding in mineral treasures. The building erected for the purpose is plain and commodious: the apartments for the

professors are handsome. There is a laboratory, a room fitted up with cabinets for specimens, a room for drawing, with a library and lecture-room. Three professors were appointed. M. Baillet, the chief engineer, gave instruction on the various modes of mining, and the mechanical means of separating the ore. M. Brochant was professor of mineralogy and geology; and M. Hassenfratz of chemistry. Twenty-five students were maintained at the expense of government. They resided partly at the mines of Pesey, and partly at Moutiers. The library and specimens were removed by the French, when they left the country, except a few old books on theology. It is said that the Sardinian government, before the late disturbances at Turin, had it in contemplation to re-establish the institution, and had arranged the plan. The existence of such an establishment, by bringing to Moutiers eminent men of science, and scientific students, gave a favourable impulse to society in this remote city, the effect of which is still very perceptible, as I had occasion to remark in the several visits I made here, during my residence in the Tarentaise. But few Eng-

lish pass this way, and still fewer remain to examine the country; and when it was known that I was come for this sole purpose, I received many friendly attentions from the inhabitants, with presents of specimens, and offers of horses to visit the mines of Pesey.

The salt-works at Moutiers are particularly deserving attention, being, perhaps, the best conducted of any in Europe, with respect to economy. Nearly three million pounds of salt are extracted annually from a source of water, which would scarcely be noticed, except for medical purposes, in any other country.*

The springs that supply the salt works at Moutiers, rise at the bottom of a nearly perpendicular rock of limestone, situated on the south side of a deep valley or gorge, through which the Doron runs, before it joins the Isere. The distance from the springs to the salt works is about a mile; the water runs in an open canal, made for the purpose, but is received in a reservoir in its passage, where it deposits part of its ocherous contents. Formerly the canal was

* In this quantity is comprised common salt, Glaubers salt, and the alkaline salts sold to the glass manufacturers.

continued to Conflans, a distance of sixteen miles, where part of the water was evaporated.

The water rises from the rock with considerable force, and emits much gas, which is principally carbonic, with a mixture of sulphuretted hydrogen; it has an acidulous and slightly saline taste. These springs rise at the end of long passages, that have been excavated in the rock. I broke off a piece of the rock in contact with the water; it is a black imperfectly crystalline limestone, coated with a thick ocherous incrustation. From the position of this rock, and its connection with those on the other side the gorge, I have no doubt that the spring rises from the lowest limestone in this part of the Alps, where it comes in contact with dark schist, or talcous slate, as I have observed to be the case in other parts of Savoy and the Haut Vallais; but the actual junction of the two rocks is not seen here. The temperature of the strongest spring is 99° Farenheit, it contains 1·83 *per cent.* of saline matter. The second spring has the temperature of 95°, and contains 1·75 of saline matter. Other sources have been discovered that contain

only 1·50 of salt. I was told that there is a deep and nearly inaccessible chasm in the rock behind the springs, which is supposed to have some connection with them. Beside common salt, the water contains in small proportions, sulphat of lime, sulphat of soda, and sulphat and muriate of magnesia, together with oxyd of iron. Much of the gypsum in this part of the Tarentaise being intermixed with rock salt, we may well conceive whence the water derives its saline impregnation; but I am inclined to believe that the high temperature of these springs, as well as of all the thermal waters in Savoy, is occasioned by an intermixture of boiling water, which rises from immense depths, being heated and forced up by subterranean fire, like the hot springs in countries undoubtedly volcanic. During the great earthquake that destroyed Lisbon in 1756, the salines at Moutiers ceased to flow for forty-eight hours, and when they flowed again, their quantity was increased, but the saline impregnation was weaker. A similar effect was produced at the same time at the hot springs of Toplitz, in Bohemia.

It may seem extraordinary that the waters at Moutiers, which have only half

the strength of sea-water, should repay the expence of evaporation; but the process by which it is effected is both simple and ingenious, and might be introduced with great advantage on many parts of our own coast, should the salt duty be entirely removed. The salt works at Bex, in the Pay de Vaud, are nearly similar to those at Moutiers, but not on so extensive a scale; and a very useful part of the process at Moutier is not adopted at Bex. Having never seen an intelligible account of the process of evaporation by faggots, I shall endeavour to give such a description as will enable any person to imitate it in this country; indeed, so little is known of this mode of evaporation by faggots, that it has been often stated by English writers, and has recently been again gravely repeated, that it consisted in throwing salt water upon burning faggots, and gathering the salt that remained. This would be a mode of making salt, as wise and practicable, as the nursery method of catching birds by putting salt on their tails.

It is obvious that water so weakly impregnated with salt as to contain only one pound and a half in every thirteen gallons,

could not repay the expence of evaporating by fuel, in any country. The water of the north sea contains $2\frac{1}{4}$ *per cent.* of salt, and yet it has never been attempted, that I know of, to make salt from it by evaporation with coal fires, even on the coast of Northumberland or Durham, where refuse coal, suited to the purpose, might be purchased for 1*s.* 6*d.* per ton. In order to make salt from the saline water at Moutiers, it was necessary to concentrate it by natural evaporation; and to effect this speedily, it was required to spread the surface of the fluid over as large a space as possible, the ratio of evaporation being, *ceteris paribus*, in proportion to the extent of the surface exposed to the action of the atmosphere. The first attempt at Moutiers was made in 1550, by arranging pyramids of rye-straw in open galleries, and letting the water trickle through it gradually and repeatedly. By this process a portion of the sulphat of lime it contained was deposited on the straw, and the water became concentrated to a certain degree. It was then carried to the boiler, and further evaporated by fuel. In 1730 the present buildings were erected by order of Charles Emanuel the third.

There are four evaporating houses, called Maisons d'Epines (literally, houses of thorns). Nos. 1. and 2. receive the water from the reservoir, and concentrate it to about three degrees of strength, viz. they evaporate one half of the water they receive. These houses of evaporation are 350 yards in length each, about 25 feet in height, and seven feet wide. They are uncovered at the top. They consist of a frame of wood, composed of upright posts, two and a half feet from each other, ranging on each side, and strengthened by bars across; the whole is supported on stone buttresses, about three feet from the ground, under which are the troughs for the salt water to fall into. The frame is filled with double rows of faggots of black thorn, ranged from one end to the other, up to the top; they are placed loosely, so as to admit the air, and supported firmly in their position by transverse pieces of wood. In the middle of each Maison d'Epines is a stone building, containing the hydraulic machine for pumping the water to the top of the building; it is moved by a water-wheel. When the water is raised to the top, it is received in channels on each side, which extend the whole

length of the building; from these long channels it is made to pass into smaller ones by the side, from which it trickles through a multitude of small holes, like a very gentle shower, upon the faggots, where it is divided into an infinite number of drops, falling from one point to another. Being thus exposed to the contact of the air, it gains one degree of strength in falling, and, by the action of the pumps, it is raised again, and falls in other showers, till it has acquired the strength required for passing to the evaporating house, No. 3.

The process is conducted with less nicety in Nos. 1 .and 2. than in the others, and, as I mentioned before, the houses are not covered. The pumps moved by the machine in the centre of the building, are distributed at equal distances on each side of the Maison d'Epines. The water is not always let to trickle down on both sides of the thorns, but only on that exposed to the wind. The two buildings, Nos. 1. and 2., are placed at different angles, to catch the different currents of wind that rush down the valley. No. 3. is constructed on the same principles as Nos. 1. and 2.; it receives the water from them both; it is 370 yards

long, and is covered, to preserve the salt water from the rain. There are twelve pumps on each side in this building, and more care is taken to distribute the water equally; here it is concentrated to the strength of twelve per cent., and deposits most of its remaining sulphat of lime; in incrustations on the twigs.

The water being now reduced to about one-seventh of the original quantity, and raised to the strength of twelve degrees, is passed along channels to the Maison d'Epines, No. 4. This is only seventy yards in length: here it is further concentrated by a similar process, till it nearly reaches the point of saturation, but this depends on the season. In dry weather, it is raised to twenty-two degrees; but in rainy, moist weather, to eighteen degrees only. In summer-time the whole process of evaporation, in passing through the different houses, is about one month; in wet seasons it is longer. The stream of water that sets in motion the hydraulic machines for raising the saline water to the top of the buildings, is brought by a small aqueduct from the river Doron. When once in motion, the process goes on and requires little far-

ther attention, or manual labour, till it is completed. When the water is nearly saturated, it passes to a large building, where are the pans for boiling, and the salt is crystallized in the usual method. That the reader may form an idea of the quantity of water evaporated before it comes to the pans, I will state the reduction at each of the evaporating houses:

8000 hogsheads, when received at Nos. 1. and 2., contain about 1½ per cent. of salt ..... reduced to 4000
4000 hogsheads, when received at No 3., contain about 3 per cent. of salt ..... reduced to 1000
1000 hogsheads, when received at No. 4., contain about 12 per cent. of salt ..... reduced to 550
550 hogsheads, received at the pans, contain near 22 per cent. of salt.

Thus, out of every 8000 hogsheads, passing through the Maisons d'Epines, 7450 are evaporated by the air in summer, and about 7000 in winter; and only one-sixteenth part of the fuel is consumed, that would be required for evaporating the whole quantity of water by fire.

The faggots are changed at periods of from four to seven years. Those in Nos. 1. and 2., where the saline impregnation is weak, will decay sooner than in Nos. 3.

and 4. In No. 3. all the twigs acquire so thick a coating of selenite, that when broken off, they resemble stems and branches of encrinites.

The Maison de Cordes was invented by an ingenious Savoyard, named Buttel. It is forty yards in length and eleven wide: it is much stronger than the Maison d'Epines, the roof being supported by six arches of stone work; the intermediate spaces on the sides being left open. In every one of these divisions are twelve hundred cords, in rows of twenty-four each, suspended from the roof, and fixed tight at bottom. The cords are about sixteen feet in length. The water is raised to a reservoir at the top of the building, and distributed into a number of small transverse canals, each row of twenty-four cords having one of these canals over it, which is so pierced as to admit the water to trickle down each separate cord, drop by drop. The original intention of this building was to crystallize the salt itself upon the cords, for which purpose the water was made use of from the pans after it had deposited a quantity of salt in the first boiling, to serve the expense of fuel in a second boiling; the re-

sidue-water of the first boiling, by repeatedly passing over the cords, deposited all its salt in about forty-five days, and the cords were incrusted with a cylinder of pure salt, which was broken off by a particular instrument for the purpose.* This process is at present abandoned for crystallizing; but the cords are still used for evaporating, and are found to answer better for the higher concentration of the water, than the faggots. This method did not answer for the first evaporation, because the water rotted the cords; but it was discovered that the cords were not soon injured by it, when it had acquired five degrees of strength. The cords, we were informed, had many of them remained thirty years in use, without being changed: indeed, they were so thickly encased with depositions of selenite, that they were defended from the action of the water. This mode of evaporating is found to be more expeditious than that of the faggots.

A sketch of the evaporating house, No. 1., is annexed; No. 2. is similar to it in every respect.

* This process might be used for sea-water with particular advantage in warm climates, and the necessity for boiling altogether avoided.

In the covered house, No. 3., there are twenty-four pumps, twelve on each side, to distribute the water more equally over the whole. This system of pumps is worked by joined bars of wood, which move backwards and forwards, and are connected by crank wheels with each piston, to raise and depress it. As I have before mentioned, they take care to evaporate on the windward side of the building. When I was on the top of No. 3., though the air was very warm, I felt an intense degree of cold, the consequence of speedy evaporation.

In the Maison de Cordes, it is found that the evaporation goes on more speedily in windy weather than in the Maisons d'Epines, as might be expected from the more ready access of air to the surface of the water. The cords are double, passing over horizontal rods of wood at the top and the bottom, to keep them firm in their positions, and at regular distances from each other. I did not see the cords without their envelope of selenite; but I was informed that they were not thicker than the finger. With the incrustations they were become as thick as the wrist.

Near the salt-springs there are the remains of a large reservoir, into which the water was formerly made to fall from a considerable height by a machine; but this mode of evaporation was only found to answer in very hot weather, and the process is given up.

The saline water is received into reservoirs from the springs, where it remains some time before it passes to the Maisons d'Epines, and here it deposits a considerable quantity, or nearly all of its ferruginous matter: the canal along which it runs to the reservoirs is also lined with a red ocherous incrustation.

The total length of the Maisons d'Epines is as under:

	Yards, English.
Nos. 1. and 2. together	700
3.	370
4.	70
Total, 1140, or nearly two-thirds of a mile.	

The fuel used at the pans for the last process is partly wood, and partly anthracite from the neighbouring mountains. The anthracite answers remarkably well when once ignited, as it preserves for a long time a

regular degree of heat. The consumption of wood was formerly so great, that it has denuded many of the higher mountains in the Tarentaise, and exposed them to the action of the atmosphere, which has occasioned vast eboulements; for it is found that forests are of the greatest utility, in preserving precipitous mountains from destruction. The fact is now so well ascertained, that the government, for this cause alone, has lately paid particular attention to the preservation of the wood. The quantity of salt made here annually, is estimated at 100,000 myriagrammes, or about 2,250,000lbs. avoirdupois, and about 9000 myriagrammes of sulphat of soda, or about 187,000lbs. The other alkaline matter which adheres to the pans is sold to the glass-makers. The government receives, on the average, 150,000 francs for the products, out of which it is estimated that 30,000 are expended for wood and fuel, 8000 for materials employed in the buildings, and for the faggots, &c., and 62,000 for the wages and the salaries of the different officers, leaving an annual profit of 50,000 francs. In some of the mountains of the Tarentaise, the gypsum is intermixed with rock-

salt en masse, and was worked by the peasants, but the places are now closed up, and so strictly guarded by order of the government, that I found it difficult to procure specimens.

These mines were formerly worked, the salt being separated from the gypsum by solution, and subsequently evaporated by fire; but the great eboulements, caused by clearing away the wood from the sides of the mountains, obliged the government to abandon the mines, and undertake the manufacture of salt at the Salines. These mines are mentioned by the Roman historians.

There is a small village, called the Salines, near the salt springs, from whence there is a wooden bridge over the Doron. Crossing this bridge, I climbed, with some difficulty, up the rocks on the other side the valley, to examine a mine in which gold-coloured fibrous rutile was discovered by Dr. Hybord of Moutiers. He obligingly accompanied me, and we had with us assistants and lights. The rock is a talcy argillaceous schist; there is also gypsum covering this side of the valley, and the upper strata are calcareous. The gypsum appears

to have sunk out of its original position. The veins, or rather irregular fissures, in which the gold-coloured rutile is found, contain quartz, calcareous spar, specular iron ore, in large laminæ, adhering to the calcareous spar, brown spar, and brown oxyd of iron, with the gold-coloured rutile in delicate aggregated parallel fibres; but specimens, containing much of the rutile, were scarce. The director of the mines of Pesey had sent miners the week before, to collect the best specimens that could be obtained. The specimen of gold-coloured rutile in the British Museum, which is stated to come from Mont Blanc, must have been obtained here, as there is, I believe, no other place in the Alps where it has been found.

When seated at the opening of the mine, and observing the rocks on the opposite side of the valley at the bottom of which the salt springs rise, they appear composed of vertical strata, and Dr. Hybord informed me that when Dolomieu visited this place, he inferred, from the position of the strata, that this limestone was of a different formation from that above it, which dips at an angle of about 45°; but the appearance

of vertical strata here is, I am persuaded, deceptive: what appears strata, are only regular laminæ, occasioned by cross seams or cleavages, the result of crystallization in the mass. One of these outer laminæ, projecting a little above the face of the rock, had the well defined rhomboidal edges of a crystal of calc-spar, as large as the side of a large house. The geological position of the warm salt springs will be hereafter considered, when I shall make some general observations on the thermal waters of the Pennine and Grecian Alps.

The valley of the Isere, from Moutiers to the Bourg St. Maurice, is awfully wild and gloomy. Vines are cultivated in sheltered warm situations, as far as Bellentres, a village twelve miles beyond Moutiers; and rye, maize, and hemp, are grown on the lower slopes, near the river; but the mountain-pastures are the principal resource of the inhabitants, and large quantities of cheese, similar to the Gruyere, are made for exportation. In some parts of this valley, and in the lateral valleys that open into it, there are considerable mineral treasures; but the unfavourable state of the weather prevented me from examining them, either

going or returning. Near Villette, on the left of the road, there is a brecciated marble, once much esteemed, and known under the name of *Breche de Tarentaise.* It contains black spots, disseminated in a deep wine-red ground. Cipoline marble, or white marble, with veins of serpentine, is found on the right of the road at Longfroy, but the quarries are not worked at present. Several mines of anthracite occur in this valley. I had less reason to regret not having the opportunity of seeing them, having visited several similar ones in the valley of the Doron, on the western declivities of the same mountains. The mines of Pesey are situated on a mountain on the right of the road, near the foot of a glacier, and are upwards of 5000 feet above the level of the sea. The ore is a dark fine-grained argentiferous galena, or sulphuret of lead, with a small portion of antimony and manganese; it is disseminated in strings and nests in the matrix of quartz. I was informed at the smelting-house at Conflans, where the silver is separated, that it contained about sixty ounces of silver in a ton. According to the account of M. Nicholas de Robillant, general inspector of mines to

the king of Sardinia, published in the Memoires of the Royal Academy of Sciences at Turin, 1785, these mines yielded annually about 4000 marcs of silver, and from 30,000 to 40,0000 quintals of lead; but the veins grew less productive, and in 1792, the value of the total produce was estimated at only 40,000 francs. The works were for some time discontinued, but when the French government established the School of Mines at Moutiers, mining operations were renewed with great activity, and are at present continued by the Sardinian government. From their great elevation, and the severity of the climate in winter, these mines can only be worked in the summer months. It is a little remarkable that the mines of Pesey were first discovered by the English in 1714, and worked by an English company from the year 1742 to 1760, when they were claimed by the chamber of the counts of Turin, and transferred to a company of Savoyards.

There are some veins of sulphuret of antimony and sulphuret of copper, and also of grey argentiferous copper ore, in various parts of the Tarentaise, but none of them appear to have been extensively worked.

I did not observe any gypsum near the road between Montiers and Bourg St. Maurice; but we were shown a mountain on the left, where it is intermixed with rock salt. At no great distance from Moutiers is the village of Centron, which has been partly destroyed by eboulements and inundations. This place is supposed to occupy the site of the ancient city of Darentasia, the capital of the Centrones, who inhabited this part of the Alps in the time of Julius Cæsar. The Centrones were intimately allied with the people called the Salassii, who were only separated from them by the Little St. Bernard. Veteius the Roman general subjected the latter people, by cutting off the supply of salt they received from the Tarentaise. On the retreat of this general they asserted their independence, and were again conquered by Messala Corvinus in the year of Rome 728. Terentius Varro, one of the lieutenants of Cæsar, made a great carnage among the inhabitants of the valleys of the Grecian Alps, and granted their lives to the remainder, according to Strabo, on condition of their delivering to him 30,000 young persons, whom he sold at Ivrea. Advancing up the

valley, we passed a church, situated on an almost inaccessible rock, which overhangs the Isere. Before we came to the great gorge, called *La Saute de Pucelle*, or the Virgin's Leap, the road passes at some distance above the river, on the side of a mountain, from whence there is a view of the upper part of La Saute de Pucelle, and the long deep chasm through which the Isere rushes. Were it practicable to pass along this chasm, the scene must be astonishingly grand. I was informed, on my return, that near the foot of the rock, there is a spring of very hot water, which I should have examined, had I known of it. About half way between Moutiers and Bourg St. Maurice, the road passes through the market town of Ayme or Aime. It was an ancient city of the Centrones, called by Ptolemy, Oxima. Several inscriptions found here prove that the Romans established a forum at Ayme, and gave it the name of Forum Claudii Centronum. Ayme is situated on the side of a steep hill, and has often been much injured by the inundations of a small rivulet which passes by it. It contains about eight hundred inhabitants. At Ayme we first saw the Maurienne female

costume. The head-dresses of the women consist of a tiara placed over the forehead, the hair being closely turned back: the tiara is composed of stripes of silk and gold lace, and must be expensive. It has rather a graceful appearance, and is worn by all the women, both at home, and when working in the fields; the hair behind is turned up, and put through a kind of heart-shaped coronet, made of rolls of ribband and ornamented with large silver pins; this is fixed on the crown of the head. This dress is common to the people of the higher part of the Maurienne, and the Tarentaise above Ayme. Approaching to the Bourg St. Maurice, the rocks are principally dark schist, in many parts invested with an incrustation of dark porous tuffa, formed by depositions from the water that runs over them.

The road from Moutiers to the Bourg St. Maurice being very bad for a carriage, it was past nine o'clock when we arrived at our inn in the latter place, though we left Moutiers at half-past two: the distance is about sixteen miles. We had heard a good character of our host and his inn, and were not disappointed; he was a respectable looking man, much like a substantial Eng-

lish farmer. Though we were now on the extreme confines of the cultivated world, immediately under the central range of the Alps, the accommodations were much better than in many of the more fertile parts of Savoy. Bourg St. Maurice being the last market-town in the Tarentaise, on the road to Piedmont, all persons who cross the Little St. Bernard must sleep here, and start from hence early in the morning. My principal object in coming here, was to cross the Alps in this direction, and visit the baths of Cormayeur in Piedmont, where I proposed to stay two days, leaving the char at St. Maurice to await our return. Cormayeur is nearly under the southern side of Mont Blanc, where that colossal mountain presents an escarpement of rock almost perpendicular, from the base to near the summit. The examination of the rocks in the valley below, called the Allée Blanche, was what I had long wished to accomplish. We rose early the following morning, but the weather, which had been very rainy, still continued threatening, and on enquiring for mules, we found that the road was so seldom travelled by ladies, that a side-saddle could not be procured for Mrs. B., and the

common saddles were of the clumsiest description. Under these circumstances, I did not think it prudent to hazard the experiment of a twelve hours' journey over the mountain, without any habitation to retreat to. With good mules, properly accoutred, this is one of the easiest passes of the central Alps in fine weather, and I believe it is far less fatiguing, than the passage of the Wengen Alp in the canton of Berne, which we afterwards undertook. The highest point of the passage of the Little St. Bernard, is 7313 English feet above the level of the sea, but I conceive it is not more than 4500 feet above the Bourg St. Maurice. Had we crossed the mountain, the weather was so rainy the two following days, that we should have seen nothing to reward us for our labour, but the clouds.

Wishing to see as much of the country as I could, in the course of the morning, I procured a mule and guide, and went as far on the passage of the Little St. Bernard as the white rock, before which Hannibal halted and encamped, previously to ascending the mountain. After leaving Bourg St. Maurice, the road ascends gradually, winding round the foot of a moun-

tain, with the Isere on the right; the bed of the river is here broad, and the ground in the vale on each side marshy. Nothing can be more dreary and desolate than the general appearance of the country in the upper part of the valley of the Isere, beyond Bourg St. Maurice to Mont Iseran, where the valley terminates. Black and frowning mountains, with a few firs on their lower slopes, and their bases covered with bare stones, brought down by eboulements, and here and there a few scattered habitations, and a marsh along the bottom of the valley, offer no allurement to the traveller, to visit the source of the Isere. At the village of Sext, the road turns to the north-east, and leaving the valley of the Isere, begins to ascend to the Little St. Bernard by a very stony road, which, in about an hour after leaving Sext, brought me to a wooden bridge over a deep ravine under the town of St. Germain. We passed the ruins of a stone bridge lower down, which was destroyed by the Austrians. The present bridge is placed very near to the white rock. The road up the Little St. Bernard, beyond the town of St. Germain, continues to ascend on the left of

this ravine to the summit, and does not appear to present any difficulty.

The white rock is a mountain mass of granular crystalline gypsum, as white as the purest snow, reposing immediately on dark bituminous schist, which dips easterly, and the gypsum appears to lie conformably on it, but the stratification seems broken and confused by subsequent disturbances. I broke off specimens, where the gypsum and schist were in junction. The rocks on the other side the bridge are coated with dark brown calcareous tuffa. One of these rocks is nearly black, and is a singular intermixture of limestone and gypsum. As the gypsum rock in the upper part was covered with soil or vegetation, I could not ascertain whether any other species of rock was reposing on it, or whether it formed the entire mass of the mountain above the schist. Admitting this to be the route that Hannibal took, there can be no doubt that the rock of gypsum, near the present bridge, is the same mentioned by Polybius, as there is no other white rock on the road to the Little St. Bernard, and this agrees in every respect with the description; but though the mass of gypsum is of vast mag-

nitude, it does not present any considerable white surface to the view, as the soil is washed over it, and has concealed it, except in parts recently fallen down. At the time when Hannibal passed however, it was probably far more conspicuous, as the softness of the gypsum rock, and the steepness of its escarpements, must have subjected it to considerable eboulements in the course of so many centuries. On leaving the valley of the Isere, before arriving at the rock of gypsum, there is an elevated plain, declining towards the valley, sufficiently spacious for the encampment of a large army, and too far removed from the mountains, to admit of any attack from above, with stones or missiles. It is here that Hannibal, in all probability, formed his encampment and halted, before ascending the mountain. This plain, and the path up the Little St. Bernard, may be seen on the road from Moutiers to Bourg St. Maurice, about a mile from the latter place, and a more distinct view of the physical geography of this passage is presented, than when you are nearer to it. I was examining it with my telescope from thence, when our voiturier surprised me by the fol-

lowing question, — " Peutêtre, Monsieur, vouz avez entendu parler d'Hannibal, général Carthaginois ?" On replying in the affirmative; " The plain you see under that mountain is the place where he halted with his army, before crossing over the Little St. Bernard." I did nòt suppose that our driver had ever heard of the name of Hannibal; and as modern historians have commonly stated that he went over the great St. Bernard, or Mont Cenis, such I expected to be the general tradition of the country, where any thing of his history was known. On enquiry, I found that the man had read a work written by a Savoyard on the subject; but the name of the author he could not remember.

After examining the gypsum rock, and those in its vicinity, I mounted my mule, to return, not without some regret at giving up the excursion to Cormayeur, as the sky was now clear; and notwithstanding the savage wildness of the country, I felt an inclination to linger near the place, over which my imagination had often hovered in early life. There are few critical moments in ancient history so pregnant with consequences involving the future fate of

the civilized world, as the opening of the morning when this consummate general broke up his camp, and resolved to proceed towards Rome. One fearful ravine was in sight, which he had yet to cross, ere he could ascend further; and that once passed, the possibility of conducting his baggage and elephants over such an elevated mountain as was now before him was still doubtful. The dangers of the descent were unknown; and the late difficulties he had encountered, and the losses already sustained, were all present to his recollection. He was, however, within four hours' march of the summits which commanded the fertile valleys of Italy; and his mind must have been alternately agitated with the most anxious forebodings, and exulting hopes of success. We know nothing of the character of Hannibal, but from the writings of his inveterate enemies, or the friends of those enemies; and it would be as unwise to rely on their accounts for veracity or candour, as on the character of Napoleon, given by English writers during the late war. That he was a man of profound sagacity can scarcely be denied: this the Roman historians called cunning; and his undaunted

courage and perseverance, were styled ferocity and audacity. His expedition over the Alps appears indeed the most rash and hopeless that was ever undertaken by any general,— yet it was successful; at least, he had success in his power at one period, and might have destroyed Rome and the republic; but it was ordained otherwise — *non fata sinunt.* Were we acquainted with all the real circumstances and motives by which the Carthaginian chief was impelled to undertake this expedition, perhaps we should find, that the attempt evinced more profound penetration and generous self-devotion to his country, than wild and daring courage.

The Bourg St. Maurice is a place of considerable traffic for cheese and cattle, which are exported into Piedmont and the Valley of Aoste. The fairs are held in the months of August and September. I have before mentioned that the Maurienne head-dress is universally worn by the women. As a proof how rarely this place is visited by English ladies, I must not omit to notice the extreme fright of a little girl, about four years of age, on seeing Mrs. B. walking in the street in a Leghorn bonnet.

Turning round suddenly, and beholding such a strange sight, the poor child lifted up both its hands, and ran away crying, in the greatest possible alarm, and hid itself behind a wall in another street, occasionally putting forth its head to discover which way the enemy was advancing; when Mrs. B. turned down the same street, it was so overwhelmed with dread, as to be unable to move, and stood screaming in the utmost agony of terror, till she had passed to a considerable distance.

We returned to Moutiers in the afternoon, less gratified with this expedition than with any we undertook in Savoy, as the main object of it was frustrated. I was, however, very well pleased to have seen the upper part of the Tarentaise. The passage of the Little St. Bernard, in the most favourable weather, must always be less interesting on the Savoy side than the passage of the Semplon, even supposing the accommodations for travelling were equally good, which is far from being the case. On returning from St. Maurice, we observed the following inscription affixed to a cross on the road —

"*Monsieur l'Archevèque de Chamberry*

et l'Evèque de Genève, accordera 40 *jours d'indulgence à tous ceux qui reciteront un pater et une avé devant cette croix de la mission, avec un acte de contrition, et l'amour de Dieu,* 1817."

Monsieur the archbishop of Chamberry and bishop of Geneva, will grant forty days indulgence to all those who will recite one pater and one ave, before this cross of the mission, with an act of contrition, and the love of God, 1817.

What kind of indulgence for forty days was to be so cheaply purchased, I could not learn. I should hope, for the credit of the archbishop, it extended no further than to eating meat on fast-days. Our voiturier refused to give his opinion on the subject: shrugging up his shoulders, he said, "Sir, I never meddle with the affairs of the church."

Baths of Pricda in the Tarantaise.

CHAP. VII.

BATHS OF BRIDA, IN THE TARENTAISE.—MOUNTAIN VILLAGES. — VALLEY OF THE UPPER DORON.

On the first evening of our arrival at Moutiers, we proceeded to the newly-established baths at Brida, in the valley of the Upper Doron, where we resided several weeks, making excursions to different objects in the vicinity. The baths are situated among the most remarkable mountains in the Grecian Alps, and the accommodation provided at the boarding houses for visitors, made this village a convenient station. The excursion to Bourg St. Maurice, described in the last chapter, was made on our return to Moutiers. From Moutiers to Brida the road is narrow and dangerous, being carried along the side of a precipice, at a great height above the river, and unprotected by any parapet-wall or fence. Chars are kept at Moutiers to convey the company to the baths, and the

drivers and horses being accustomed to the road, may be safely trusted, though it is not possible to travel the present road in a char without feeling alarm; but as the distance is not more than two leagues, the dangerous parts may be passed on foot. Should the baths succeed, it is intended to make a new road along the bottom of the valley. Dr. Hybord, the physician at Moutiers, informed me, that in going to Brida his horse took fright, and fell over the precipice, but fortunately his coat was caught by the point of a projecting piece of wood, and he hung suspended till he, seized hold of some bushes, and with much difficulty climbed up to the road.

About one mile from Moutiers we passed the ruins of the ancient residence of the archbishops of the Tarentaise. The first printing press, introduced into Savoy, is said to have been established here.

It may be proper to notice, that there are two rivers in Savoy which have the name of Doron; the one rises in the district of Beaufort, and falls into the Arly, a little before its junction with the Isere. The other runs from the mountains west of the upper Isere, and falls into that river

at Moutiers. The valley through which this river runs may be called the valley of the upper Doron, as I do not know that it is yet designated by any appropriate name. It is very imperfectly laid down in all maps that I have seen, except the grand map of Mr. Raymond, entitled *Carte Militaire des Alpes;* a map unrivalled for accuracy.

After ascending about two miles, the road turns to the south-west, and the scenery of the valley of the upper Doron opened on the view as we proceeded. It is altogether different from that of the upper Isere, and is far more rich and magnificent.

The bottom of the valley is extremely narrow, there being scarcely any flat or meadow land in its whole course. The Doron rushes along it in a rapid descent of about fifteen miles. The lowest slopes in the valley are covered with vineyards; above these corn-fields and pastures, mixed with forest trees, villages and chalets rise to a great height, and give a very chearful appearance to the country; but the most striking features are the sublime and snow-clad mountains, by which the upper end

of the valley is closed; they rise several thousand feet above the lower line of eternal snow, and are seen towering over a perpendicular wall of black frowning rock, which contrasts finely with the dazzling whiteness of the snow. In the centre, the summit of the Planey overtops the rest, like the dome of an august temple; nearer on the right, is the fantastic spire of the Aguille de Vannoise, a taper pyramid of rock, at least 8000 feet in height: more advanced in the valley is the Pan de Sucre, a mountain of gypsum, in the form of a compressed and truncated cone, higher than Snowden. The view given, Plate III., will convey a correct idea of the outline of these remarkable mountains, and as it was taken in the middle of August, it marks the lowest line of snow in summer. Before arriving at the baths, the road descends to the bottom of the valley, and we crossed the Doron on a wooden bridge, lately erected, the former bridge having been carried away by the inundation in 1819. We alighted at the hotel where we had been recommended: here we dismissed the voiturier, who had brought us from Aix, and whom we had ordered to follow

us from Moutiers, expecting to return the next day, but we were so much struck with the singular appearance of the valley, that we determined to remain here some time, and examine a country hitherto undescribed.

Five or six houses are already fitted up for the reception of company, and others are building, as the baths are rapidly rising in reputation.

The house at which we were, had been the summer residence of a large landed proprietor, a range of new lodging-rooms being added to it for the company; the charge for each person was four francs and a half per day for apartments, dinner, supper, and wine. A separate charge was made for coffee. These terms may be considered moderate, as almost every article of consumption, even the bread, was brought each day from Moutiers. The table was as well supplied with beef, veal, poultry, and ham, as this part of Savoy could furnish; we had also a desert, and plenty of strawberries and ice from the mountains; the wine was better than at the public table at Aix.

As these waters were as yet but little known out of the dominions of the king of Sardinia, the company at Brida con-

sisted almost entirely of Piedmontese and natives of Savoy, among whom were several of the nobility from Chamberry, and a number of the clergy. We were, excepting one gentleman, the first English who had visited these baths, and we found the company, both at our own hotel and the neighbouring houses, disposed to shew us all the civilities that lay in their power to make our residence agreeable; these attentions diminished the melancholy feeling of being surrounded entirely by strangers. Perhaps there is no better way of becoming acquainted with the modes of thinking and habits of a people, than by living with them some time at a watering place, where they happen to be unmixed with other nations. We met with several among the native Savoyard gentry who possessed much sound sense, united with considerable general and local information. The unfortunate situation of Piedmont, prevented any political conversation at the public table, but in private they spoke freely; and here, as well as in other parts of Savoy, there is but one feeling, which is that of indignation, at being transferred to their old rulers, without any stipulation for their

liberties, contrary to the universal wish of the whole nation.

The mineral waters of Brida, were noticed in the ancient records of Savoy as the waters of La Perriere, on the confines of which commune the present spring is situated. The former spring was covered by a sudden inundation of the Doron and lost; but the period when this happened is not known. In the summer of 1819, the breaking down of the side of a glacier produced an inundation similar to that of the Dranse, above Martigny, in the Vallois, which occurred in 1818. The upper part of the valley of the Doron is divided into two branches, the one extending to the mountains in the Maurienne, the other to those of the Upper Isere; the torrents which pour down each of these valleys unite and form the Doron. It was from the latter branch the inundation descended, bringing with it an immense quantity of débris, and tearing up the banks of the river in its course. When the inundation had subsided, the bed of the river at Brida was changed, the waters deserting the western bank, and forming a new channel further east. A miller and his family, who lived

close to the river, narrowly escaped with their lives. He lost most of his little property, as the building where he kept his wine and winter stores was swept away. The following winter, the miller's wife observed steam constantly rising on the opposite bank of the river, and on going to the spot, she found a considerable spring of hot water, of which she occasionally availed herself for domestic purposes. When the circumstance became known, Dr. Hybord, the physician at Moutiers, examined the water, and finding it was sulphurous and aperient, he gave his opinion that it might be salutary for scorbutic and other disorders, used both externally and internally, and recommended some of his patients to try it. The benefit they received exceeded his most sanguine expectations. This induced some of the inhabitants of Moutiers to form themselves into a company, and build baths, &c., in the expectation of its proving a profitable speculation. They first began with making an embankment round the spring, to secure it from future inundations.

Early in the summer of 1820, many remarkable cures had been effected by these

waters; and in the course of the autumn and the following summer of 1821, they were much frequented. When we were there in the month of August, the boarding houses were all full, and we understood that nearly eighty persons bathed every day, besides those who drank the waters. One of the most extraordinary cures, and what first gave the waters celebrity, was the case of an elderly woman in the neighbourhood affected with a dropsy, which had been declared incurable. Dr. H. recommended her to take as much as five or six pints of the water a day, as an experiment. Unexpectedly finding much relief, she determined to increase the quantity to what was considered a dangerous excess, when, to the surprise of every one who knew her, she daily diminished in size, and in the course of three or four weeks was perfectly cured, having lost 28lb. weight. In cases of nervous debility, the warm baths are said to be particularly efficacious, and also for rheumatism and scurvy; but the waters are considered dangerous, where there is any tendency to inflammation in the constitution.

The season for visiting the baths of Brida

commences about the middle of June, and terminates near the end of September. The charges are very moderate. One great advantage that these baths possess over those of Aix or St. Gervaise, is that the air in the valley of the Doron is particularly bracing and salubrious.

Dr. Hybord obligingly furnished me with the following statement of the saline ingredients contained in these waters; a regular analysis of the proportions had not been made. The temperature of the water, owing to an occasional intermixture of top waters, varies from 27° to 29° Reaumer, or from 93° to 97° Fahrenheit. They contain 148 grains of saline matter in each killogramme, or about the $\frac{1}{117}$ part.

The principal salts are,

Sulphat of magnesia,
Muriat of soda,
Sulphat and carbonate of lime.

Besides which, they contain a small quantity of sulphat of soda, carbonate of magnesia, and carbonate of iron, with a trace of alumine and silex. The gaseous products are carbonic acid, and sulphuretted hydrogene; there is also a portion of petroleum

floating on the water, and an ammoniacal efflorescence forms on the planks that cover the spring. The waters rise with much ebullition, as the quantity of gas they contain is very considerable. I examined the rock from which they spring; it is a greenish talcous slate, very soapy to the touch, and much contorted. The water issues near the junction of this rock with limestone. The smell of sulphuretted hydrogen is very perceptible. To the taste the waters are like a mixture of the Cheltenham and Harrowgate, with a temperature approaching that of the Bath waters. A chemist came over from Turin while we were at Brida, to analyze the waters, by the desire of the proprietors of the baths; but some mystery was made of his proceedings. It is possible he was afraid of giving offence by making a too favourable report of the spring, as the Sardinian government interferes so much with whatever can affect the revenue, that it may probably look with no favourable eye on those new baths, lest they should take away company from the baths of Aix. I should therefore be inclined to receive with much caution any report made by persons under the imme-

diate influence of the government. The statement above given of the saline and gaseous contents of these waters, can only serve to point out the principal ingredients. I had no means with me of verifying them by tests, but the taste is sufficient to indicate the presence of muriate of soda, combined with magnesian salts. The presence of carbonic acid and sulphuretted hydrogen, in considerable quantities, is also appreciable by the senses. It will therefore be readily admitted, that waters possessing these ingredients, with a natural temperature of 96° or 97° degrees, may produce a powerful effect on the animal system; and those who take them internally, find they act as a mild but efficacious aperient, unaccompanied by nausea or debility.

The miller I have before mentioned is regarded as the wonder of the place. He is an elderly man, with handsome features, a fresh complexion, and a lively intelligent expression of countenance. He is one of those happy beings gifted by nature with great capability of action, fertile in resources, and possessing those buoyant spirits that smile at common calamities, and

regard them only as motives for additional exertion. After the destruction of a great part of his property by the inundation in 1819, he lost no time in useless lamentations, but immediately began not only to repair, but to improve his premises, and provide as much as possible against the recurrence of similar misfortunes. He excavated, by his own hands, a large cellar in the solid rock above the mill, partly by the pick and partly by blasting; here his wine and winter provisions are safe from any natural power of destruction less formidable than an earthquake. His name, with the date, October, 1820, cut in the rock above the door, record his labours. The most extraordinary of his performances, and one, indeed, which almost exceeds belief, is the removal of an immense block of marble, which he worked into a mill-stone for crushing walnuts. The block had fallen into the valley about three hundred yards beyond his mill. He long viewed it with a wishful eye, but the removal seemed beyond his power; he was, however, then in the vigour of life, and he resolved to attempt it. He began by cutting the stone into a proper form, which was a

labour of many months; when this was done, by the aid of his wife, his mother, and his servant-boy, and with some miserable pullies procured from Moutiers, he contrived, by great labour, to raise it by little and little, and then, for several successive weeks, he continued to move it a few inches or a few yards a day, according to the nature of the ground. At length he brought it safely within his mill, and placed it in its present situation. The date on the stone is 1796. The millstone is about nine feet in diameter, and three feet in depth, with a circular groove for a roller to work in, to crush the kernels of the walnuts, and form them into a paste, before pressing out the oil. The present weight of the stone cannot be less than fourteen tons, as it contains about 189 cubic feet of marble, and the specific gravity is at least 2.70. The removal of this stone with the very slender means by which it was accomplished, is one of the most striking instances I am acquainted with, of the great objects which manual labour can effect by unremitted perseverance. It has procured the man a great reputation in the country, as it is considered almost miraculous; he bears, beside, an

excellent character. In some of my geological excursions, I took him with me, and he related various circumstances in his life, that were sufficiently interesting to have formed the subject of an instructive moral tale.

As his wife discovered the mineral springs, I was desirous that he should derive some advantage from the discovery, and recommended his keeping mules to let out to the company, and cows to supply them with milk during the season. With these suggestions he was much pleased, and should he adopt them, he will be useful to future visitors, as there is not a horse or mule with a saddle to be hired in the place. The only saddles are wooden ones with ropes for stirrups, and in the summer months, all the cattle are upon the pastures in the mountains, and we could only procure milk to our breakfasts once or twice a week.

The valley of the Upper Doron lies between the valleys of the Maurienne, and the upper valley of the Isere. The mountains on the east, separate it from the latter, and those on the west from the former. Beside the Pan de Sucre, (perhaps one of

the largest gypsum mountains in the world,) there are other masses of gypsum both on the summits of the mountains, and at the very bottom of the valley, of which I shall afterwards speak. It is perhaps owing to the quantity of gypsum, which reflects a large portion of the solar rays, that vines are cultivated to so great a height in this valley; but in the summer of 1821, when we were there, they had entirely failed. It will be well remembered, that the spring of that year had been remarkably cold all over Europe. Wheat and potatoes are grown at great elevations here, and appeared healthy and productive. I observed that the walnut trees in the upper part of the valley had suffered from the cold, and the nuts were blighted. As this valley descends from the central chain of the Alps, and the river which runs along it, forms a continued cataract of fifteen miles in length, it may be regarded as one of the most elevated large valleys in Savoy; hence I was surprised to find it so well cultivated and productive.

Wishing to examine the upper part of this valley, we engaged a char from Moutiers, and set off early in the morning, tak-

ing provisions with us. There is a road on each side of the river from Brida, but it is only that on the western side that is practicable in a char; the other is only a path for mules. Both roads are carried at a great height above the river.

Leaving Brida, the road passes above the baths, and continues ascending gradually for three miles. The first rock near the road is a Cipoline marble, or white limestone, spotted with greenish talc. It lies above the rock of talc slate, from which the thermal waters issue, and is evidently connected with it. A little further we passed over an immense eboulement, which had covered some hundred acres of ground; the fragments of rock appeared all of one kind, which was grey-wacke slate, intermixed with particles of quartz. The snowy mountains at the end of the valley were in full view all the way, and we could perceive that the snow was diminished in various parts, as there were more projecting points and ridges visible than on our first arrival at Brida, the weather for some days having been very hot.

There are several mountain villages at a great elevation on each side of the valley.

As nearly as I could estimate by the eye, some of these villages were from 2000 to nearly 3000 feet above the river, and therefore from 4 to 5000 feet above the level of the sea; few villages in the Alps are placed higher. The village of Murren, above Lauterbrun, in the canton of Berne, is stated to be 5466 feet above the sea, and 2700 above the vale of Lauterbrun; but it did not appear to me to be so high above the valley, as some of these villages near Brida.

To an Englishman, at the first view, it may appear strange, that the natives of Savoy or Switzerland, should so frequently build large villages in such lofty situations, where they must remain shut out from the world for many months during the winter, and be exposed beside to numerous hardships, which the inhabitants of valleys escape.* A little reflection will sufficiently explain this choice of situation. In a country where land is much divided, and

* I do not recollect any village in England (and I have been in every county except Hampshire,) which is situated more than 1000 feet above the level of the sea. The situation of a few straggling houses, or miners' huts, may exceed that elevation.

small proprietors cultivate their own property on the mountains, it is absolutely necessary that they should reside near it, otherwise a great part of their time and strength would be exhausted in ascending and descending, as it would take a mountaineer four hours in each day, to ascend to many of these villages and return to the valley. In building their houses on the mountains, they place them together in villages, when it can be done, and at a moderate distance from their property, to have the comforts of society, and be more secure from the attack of wolves and other wild animals. Potatoes and barley can be cultivated at the height of 4500 feet in Savoy, and these, with cheese and milk, and a little maize for porridge, form the principal part of the food of the peasantry.

Several of the mountain villages, with the white spires of their churches, form pleasing objects in the landscape, but on entering them the charm vanishes, and nothing can exceed the dirtiness and want of comfort which they present, except the cabins of the Irish. Yet habit, and a feeling of independence, which the mountain peasant enjoys under almost every form

of government, makes him disregard the inconveniences of his situation and abode.

" Dear is that shed to which his soul conforms,
And dear the hill that lifts him to the storms,
And as a child, when scaring sounds molest,
Clings close and closer to his mother's breast,
So the loud torrent and the whirlwinds roar,
But bind him to his native mountains more."

GOLDSMITH.

The mountain pastures, situated above the line of cultivation, are the property of rich individuals in the valley, or belong to whole parishes and communes. In the former case, the proprietor has chalets on the mountains for his servants, who go there with the cattle soon after the snow is melted, and remain in these elevated situations during the summer months, being employed in taking care of the cows and in making cheese. The proprietors visit them occasionally, to examine the state of their cattle and dairies. When we had travelled a considerable way up the valley, we met a party in their holiday suits, and their heads decorated with Alpine flowers. The party consisted of an elderly female, mounted on a mule, her son and

two daughters, on foot, and a servant girl on an ass. The mother, as we were informed, was a considerable proprietor, and was returning with her family from the mountains, where they had passed two or three days to inspect the progress of their dairy. I confess there was something peculiarly pleasing in the sight of this family group: it recalled to mind the simplicity of the patriarchal age. The young people evinced much hilarity; by them this visit to the mountains was evidently regarded as an excursion of pleasure. The ass, in ascending, had been laden with their wine and provisions; for, on such occasions, the proprietors and their families are obliged to sleep in the chalets.

When the property belongs to a whole parish, or commune, there are public days of inspection, and certain regulations are adopted, of which some account will be given in the chapter which treats of the agriculture of Savoy.

About six miles from Brida the road descends to the river. After crossing it on a bridge, we came to Boshel, a large town, where courts of justice are held, but the place is more celebrated from the chapel of

the Virgin, called Notre Dame de Boshel. The chapel is an appendage to a large church, and contains an image of the Virgin in wax, larger than life, placed in a glass case over the altar. The hair is dressed and powdered in the old court fashion; she has on a hooped petticoat, and her silk gown is richly bedizened over with gold tinsel. This gaudy representation of the queen of virginity, is held to possess the miraculous power of conferring fecundity to those married but childless dames who shall come here, in faith, to implore her assistance.

We were told that every year nearly two thousand women make a pilgrimage here to implore the assistance of Notre Dame de Boshel, and that the greater part return satisfied. If this be so, I must leave to Catholics the explanation of the miracle, —there is no monastery at Boshel.

A lady from Chamberry told Mrs. B. that she went up the valley to Boshel one morning, with a party of female friends from Brida. Not thinking of the wonder-working powers of our Lady of Boshel, they were surprised to see the peasants they passed on the road making significant

signs to each other, smiling and winking, and throwing out mysterious jokes, which they could not comprehend, nor the cause of this behaviour, so extraordinary in the peasants of the country, who are remarkably respectful to strangers. On their return the mystery was explained; they had been mistaken for pilgrims going to ask aid from the Virgin; and as some of the ladies were far advanced in life, their supposed faith and expectations had been subjects of mirth to the peasantry, who could not conceive any other motive for their travelling to Boshel but the desire of having a family. There is no end to the labours that superstitious Catholics expect the Virgin to perform, without regarding her repose or dignity. She is made to possess the attributes, and discharge the functions, of almost every goddess in the heathen pantheon. At Paris she is known as Bellona, the goddess of war and victory, under the name of *Notre Dame des Victoires;* sometimes she is invoked as Lucina, and *Notre Dame de Boshel* supplies the place of the Venus Genetrix of the ancient Romans.

From Boshel we passed up the valley on the northern side of the river, as far as a

village called Villard Goitrou, where the road divides, and is no longer practicable for a char: the road on the left passes over the mountains into the valley of the Isere, and that on the right to Lans le Bourg, in the Maurienne, at the foot of Mont Cenis. The *Pan de Sucre*, the remarkable conical mountain of gypsum, was now immediately above us, on the opposite side of the river. Seen from hence it is a most magnificent object. Its northern extremity presents a pyramidal mass of bare rock, rising very precipitously from the vale to the height of 3500 feet. As far as the fact could be determined by its appearance, this mountain is formed of the same mineral substance from the summit to nearly its base. Had the gypsum been interstratified with any other rock, the edges of the other strata would have been seen projecting, which I could not observe to be the case. On the eastern side of the mountain, however, the gypsum reposes on a base of rock of a different kind, which is much contorted, and is either mica, or talcous slate, similar to what abounds elsewhere in this part of the vale, but it was inaccessible. We had our provisions carried to the

base of this mountain, and dined under its shade. The gypsum is snow-white and granular; it resembles in its structure the purest refined sugar. We ascended a ravine in the mountain to some distance, and had an opportunity of observing the beds of gypsum which here appeared to rise to the west north-west, and were not intermixed with any other kind of strata.

On the road from Boshel to Villard Goitrou, we passed similar beds of gypsum, near the bottom of the valley. The occurrence of a mass of gypsum, forming apparently the greater part of an isolated mountain, rising from 3000 to 4000 feet above its base, is a geological fact which, as far as my own information goes, is unique. The northern side of the mountain, facing Brida, is partially covered with a scanty vegetation, and has a brownish orange-coloured tint, which gives it a very singular appearance. Forest trees are thinly scattered over its base. The side opposite Villard Goitrou is quite bare, and is covered with débris from the summit. From the natural softness of this species of gypsum, a mountain of so great an elevation, and rising very abruptly, must crumble and *di-*

minish rapidly, in those parts which are unprotected by a covering of soil or vegetation, and such appears to be the case.

At Villard Goitrou the valley terminates, or rather divides into two branches, through each of which there runs a considerable torrent; these unite here, and form the Doron. It was down the valley on the left, that the great inundation descended, which occasioned so much damage in 1819. It gave no previous notice of its approach, except by a tremendous roaring, the cause of which was unknown to the inhabitants of the village of Villard Goitrou; they had scarcely time to escape on the rocks behind the town, when they saw the water instantly rise nearly to a level with the roofs of their houses, and many of the houses were entirely swept away. Near the junction of the two rivers, or torrents, that form the Doron, there is a small plain; this is almost entirely covered with immense blocks, chiefly of quartz rock, which were brought down by the inundation, and left there. A few of the blocks are mica and talc slate, shewing the nature of the rocks in the upper part of the valley. The cause of this inunda-

tion is supposed to be the sudden breaking up of a wall of ice, which had dammed up the waters in a narrow valley upon the mountains, forming a small lake. On the breaking of the ice, the whole body of water rushed instantly down, tearing up and carrying away, by its velocity and weight, every thing that opposed its passage.

We walked along the branch of the valley which turns to the right, thinking to have a nearer view of the Aguille de Planois, but the view was here intercepted by intervening rocks. On the right of our road we observed a tremendous cataract, formed by the fall of the river, which may be called the right branch of the Doron. The bed of the river is a profound chasm; but from an elevated part of the road, we scrambled along the side of a precipice which brought us to some rocks that form a natural arch, over the lower part of the cataract. Imagine a considerable river, which had acquired a great velocity by previous descent, bounding down between overhanging rocks into a chasm 200 feet deep, with a noise like the loudest thunder, and with a percussion that made

the ground on which we stood shake under us. The black colour and savage aspect of the rocks above, greatly contributed to heighten the effect, which was truly awful. The descent from the first fall to the bottom of the chasm is about four hundred feet. The peasants on the road told us it was called *le Gorge de Bellentre.* In returning, the precipice along which we had passed seemed more terrific than on our approach, and I found the most secure method of advancing, was to turn my back to it, and catch hold of the plants above. Our only path was along a track a few inches wide, that had been trodden by the sheep. On the plants and scattered herbage were an infinite variety of insects of the most beautiful and dazzling colours, enjoying the warmth of the direct rays of the sun in August. It was a living cabinet of specimens, which the entomologist would have been delighted to contemplate. In this southern part of Savoy, there are several rare insects, that are not found in any of the mountains in Switzerland. Returning to the village of Villard Goitrou, we saw a number of the most miserable objects collected round our char, which was quite

a novel sight to them, as there is no road for a carriage of any kind beyond this place. Villard Goitrou owes its latter appellation to the goitres with which the inhabitants are affected: perhaps there is no other village in the Alps, where so large a proportion of the population have either goitres or are cretins. Both these calamities are often united in the same person.

There must be some physical peculiarity in a place where certain maladies are thus engendered and perpetuated for a succession of years, or even centuries; but after all that has been written by eminent medical men on the causes of cretinism and goitres, the subject is still involved in much uncertainty and obscurity. It is said that the inhabitants at the extremities of valleys are most liable to be affected with these complaints. This has been attributed to the stagnation of warm air in such situations; but though Villard Goitrou is at the extremity of a larger valley, two smaller ones open into it, which must produce constant currents of air. It is placed also on the sunny side of the valley, which is supposed to be less productive of cretins and goitres, than the side which is in shade. It is apparently

beyond the range of the calcareous strata, and therefore the water is not likely to be charged with carbonate of lime, which has sometimes been thought to produce goitres; there may, however, be gypsum on some of the mountains above this village. The surgeon at Brieg, at the foot of the Semplon, told me, that he attributed the prevalence of goitres and cretinism, in the mountain villages in the Haut Vallais, to want of cleanliness, and to their sleeping in cabins, from which the air was almost entirely excluded, in order to keep themselves warm. A deficient or unwholesome diet, has also been supposed to increase the effect.

That none of the causes here enumerated will satisfactorily explain the origin of goitres or cretinism is obvious; for goitres occur where these causes can scarcely be supposed to operate in any sensible degree. Thus, at Geneva, though the streets are narrow, and the areas of the houses are close, yet the situation is dry, the air may be called salubrious, and the streets are kept clean. In personal and domestic cleanliness also, the Genevese are by no means deficient, yet they are often affected with goitres; and even the children of English families who

reside at Geneva for a short time, are not unfrequently attacked with an enlargement of the neck, or with incipient goitres.

In various parts of our own island, the natives are effected with goitres; but it is, I believe, always in hilly or mountainous districts. Soon after our return from the continent, we visited Monmouth, and to my astonishment I saw that a great number of the country people who attended the market, had goitres of a monstrous size, that rivalled the goitres of the Alps. Many of the people thus affected with goitres came from the forest of Dean, which is table-land, covered with sandstone strata of the coal formation, and the limestone on which they rest, is at too great a depth to affect the water.

One fact must be generally admitted, viz. that it is the inhabitants of mountainous or hilly countries who are principally affected with goitres, for they rarely or ever occur among the natives of low or level countries, at a distance from the mountains. But we cannot ascribe the existence of goitres to the action of carbonate of lime alone, as the natives of mountainous dis-

tricts are sometimes affected with goitres on siliceous, as well as on calcareous soils.

Were I to hazard a conjecture on the the subject, it would be that goitres are produced by almost any kind of mineral matter, finely comminuted and suspended in water. We are scarcely aware of the extreme degree of minuteness to which the particles of mineral matter may be reduced by continued falls of water; in this state the mineral matter may afterwards remain chemically or mechanically suspended in the water, without affecting its transparency. The extreme minuteness of the particles may enable them to pass into the vascular system, and ultimately occasion obstructions in the smaller vessels.

An English gentleman at Geneva told me, that his children began to be affected with goitrous swellings after a few months residence in that city, and the physician who attended them, ordered the water which they drank to be boiled, and remain to deposit its earthy contents. By following this advice, the swellings were removed; but when the children went afterwards to Lausanne, the servants neglected to boil

the water, and the goitrous appearances returned, but they were again removed by boiling the water as before.

In situations where children are greatly subject to goitres, it is possible that an unwholesome or scanty diet, combined with bad air and want of cleanliness may produce so great a degree of debility, as to injure the powers of life, destroy the intellectual faculties, and terminate in cretinism.

With respect to cretinism, the cause seems distinct from that which produces goitres; all cretins have not goitres, neither are all who have the external appearance of cretins deficient in intellect. Cretinism, when once generated, appears to be hereditary. The guide who conducted us from Villard Goitrou to a coal mine in the vicinity, was in appearance, a dwarfish boy of about fourteen years of age, broad shouldered, with a flat, frog-shaped head and face, and an expression of countenance which indicated a mixture of cunning and intelligence. He was evidently of the race of the cretins, though he seemed no way wanting in sense. A little child of the same race was running after him; I said, "That is your younger brother, I suppose?" He re-

plied, " *Pardon, Monsieur, c'est mon fils.*" I could scarcely believe he was serious; but on further enquiry, we learned that our dwarfish guide was thirty years of age; he had been married eight years, and the child who followed us was seven years old. He bore a strong resemblance to his father.

To return from this digression: the persons round our char at Villard Goitrou, presented the most melancholy picture of the physical degradation of our species I had ever beheld, united with an extreme degree of poverty and destitution, equalled only by that of the poorest wretches in Ireland, with goitres so large, as to bear a considerable proportion to their dwarfish bodies; with heads, features, and forms scarcely human, many of them unable to speak, but expressing their wants by grating noises and uncouth signs; they exhibited all the horrors of deformity, combined with idiocy and extreme wretchedness. It was impossible not to feel compassion for beings so degraded by nature, whose misery was unmerited by any moral crime. It is, however, some consolation to believe that they are not sensible of their degradation, as they appear cheerful, and are said to evince much

affection towards those from whom they receive kindness.

In the group collected to witness our departure, were a few tall, well-made, handsome men and women; their curiosity was much excited by this unusual visit of strangers; they gave us an account of their escape from the inundation, and were much pleased by the little donations we made to the poor cretins; but more so by the commiseration with which they saw we regarded them. An elderly respectable looking old man, who seemed the patriarch of the village, called after us when set off, and ran to our char. I could not imagine what he wanted: it was to take me by the hand, and give me his valediction, which he delivered with much earnestness and evident good will, concluding with a prayer for our safe return to our own country. The tears glistened in his eyes whilst he spoke; and I confess, I was more seriously impressed by his benediction, than I should have been by the blessing of the highest prelate in Christendom.

Above Villard Goitrou, and on our return from that village, we visited some mines of that species of coal, called by

mineralogists anthracite, which burns without flame or smoke, and nearly resembles plumbago in its external appearance; but of these mines, I shall speak in the following chapter, which will be devoted exclusively to observations on the geology of this valley and its vicinity.

CHAP. VIII.

OBSERVATIONS ON THE GEOLOGY OF THE VALLEY OF THE UPPER DORON, FROM NEAR MOUTIERS TO VILLARD GOITROU.

In what I am about to state respecting the geology of this valley, and other parts of Savoy, I am aware that I shall differ essentially from the opinions of several eminent geologists, who have mentioned the Tarentaise. I should have felt great hesitation in doing this, had I not been enabled, by a residence of several weeks, to prove the inaccuracy of some of those opinions by decisive facts.

Long after the Alps had been explored by geologists, it was universally admitted that the greater part of the mountains were what are called primary. This opinion was founded on the association of these rocks with others which were allowed to be so, such as granite, mica slate, and talcous slate. M. Brochant, who resided some

time in the Tarentaise, was, I believe, one of the first who advanced the opinion, that many of the rocks in this district ought to be classed with transition rocks, and that the gypsum which is of such frequent occurrence, is a later formation, covering the other rocks unconformably. M. Brochant was assuredly right in removing the calcareous rocks from the rank of primary, to which they are so far from being entitled, that I believe they belong to the upper secondary strata, corresponding in position to the English strata above the coal-formation. With respect to the gypsum in the Tarentaise, I have decisively ascertained that it is subordinate to the limestone, and interstratified with it, and therefore both must be considered as cotemporaneous. The coal-formation, or anthracite, in this part of the Alps will be found, I believe, to correspond in position with the regular coal-formation in England, though it may differ from it in quality; but not entirely so, for some of the coal in our regular coal-formations is also anthracite. *

* Anthracite is that species of coal which burns without smoke or flame; it bears a strong resemblance to plumbago (graphite), into which it is supposed to pass.

On the other hand, many of those rocks which bear the characteristic marks of secondary, are associated with talcous slate, which again passes into talcy mica slate, and is apparently associated with the granite of the Alps. That this granite is also of comparatively recent date, may seem too bold an inference to be admitted, at least by the geologists of the school of Werner. M. Brogniart, in a small work, entitled, "*Sur le Gisment ou Position relative, des Ophiolites, Euphotides et Jaspes, &c. dans quelques Parties des Appennines,*" which he obligingly gave me as I passed through Paris, has proved that certain rocks, allied to talcous slate and serpentine, which have been generally regarded as cotemporaneous with primary, or with the older transition-rocks, are in reality posterior to secondary limestones, and sandstones, of comparatively recent date, as they may be seen covering the latter rocks. Hence we may feel less hesitation in admitting that the talcous slate of the Alps, with the talcy mica slate, and the talcy granite, (improperly called protogine,) are more nearly allied to secondary rocks, than has been hitherto imagined. But geologists have

many deep-rooted prejudices to surmount before they can examine Nature with impartiality, or trust freely to legitimate inferences from acknowledged facts.

The principal rocks in the valley of the Doron are,—

1. Limestone, distinctly stratified, intermixed with talcous slate, and steatite.

2. Anhydrous gpysum, interstratified with limestone.

3. Common gypsum, highly crystalline, and sometimes containing sulphur.

Below these are,—

4. Bituminous schist, passing into clay-slate, and dark micaceous sandstone, with anthracite. From an excess of mica, this rock appears to pass into mica slate.

5. Grey-wacke, highly indurated. Position uncertain.

6. Talcous slate, passing into talcy mica slate.

In the higher parts of the valley there is quartz rock, granite, and other primary rocks, which I did not see *in situ*.

The limestone of this valley consists of the lower beds of the great calcareous band, that covers the northern side of the Savoy Alps. It is distinctly stratified, and re-

sembles in position, and in all its characters, the lower limestone on the eastern side of the lake of Annecy. They both occasionally contain veins of quartz. This limestone is hard and subcrystalline, varying in colour from a light yellowish grey, to smoke grey, and blackish brown. It is in some parts coloured red, in veins and in blotches. The bed immediately above the salines of Moutiers is a blackish brown. Though this limestone, like that of other parts of Savoy, has the hardness and crystalline structure of our mountain and transition limestones, yet, as I have elsewhere observed, this can determine nothing respecting its relative age, as limestones that contain these characters in other parts of Savoy are undoubtedly cotemporaneous with our upper secondary formations, if this can be decided by the organic remains they contain. In a former chapter I have mentioned the shells found in the limestones on the lake of Annecy, particularly that characteristic shell, the gryphœa arcuata. M. Brochant found the remains of a nautilus in the marble of the Tarentaise, which must be regarded as belonging to the upper secondary strata; and in one of the

lowest beds, east of the salines at Moutiers, I discovered the distinct impression of small cardites, and one shell, which an eminent conchologist, to whom I shewed it, supposed to be a patella. The great degree of induration which the limestone in this valley has assumed, seems to have nearly obliterated all traces of organic existence, as they are rarely to be discovered.

Where the limestone approaches the gypsum, it contains, like the gypsum, an intermixture of soft talc or steatite, and it is also interstratified with schistose beds of soft talc, and beyond the baths it appears to cover a talcous slate, that approaches to the nature of oolite. This limestone sometimes reposes upon dark bituminous schist, and sometimes on a coarsely aggregated rock, which may be called either sandstone or grey-wacke, according to the views of different geologists. If it can be proved that rocks formerly regarded as the very oldest transition rocks are found posterior to upper secondary strata, we shall have little difficulty in admitting, that grey-wacke may be found there also; and if the upper secondary limestones in Savoy assume the mineralogical characters of our old lime-

stones, which they assuredly do, we can have no hesitation in admitting, that the associated sandstone strata, may assume the characters of grey-wacke.

There is one mass of a hard siliceous rock, containing fragments of the older rocks, at the bottom of the valley, near the baths, but I am inclined to believe that its position is what geologists call unconformable.

The gypsum in this valley, I am prepared to show, alternates with the calcareous strata. This gypsum has been described by M. Brochant, as lying unconformably over all the other rocks in the Tarentaise. I have the greatest respect for the talents of this eminent professor, and without positive proof, I should not have presumed to differ from him on the subject, as he formerly resided for some time at Moutiers, and had of course an opportunity of examining the country.

Dr. Hybord, the physician at Brida, had formerly paid attention to mineralogy: when speaking to me of the gypsum, he said that it invariably covered the other rocks "*comme une chemise.*" The question respecting the position of the gypsum in

the Alps, has hitherto divided the opinions of geologists; but the facts I am about to state no longer leave any doubt on the subject. I will first describe the varieties of gypsum in this valley.

The gypsum of the valley of the Doron is of two kinds, or what mineralogists would describe as two species, — granular common gypsum, and anhydrous gypsum.

The granular gypsum is generally snow white; but on the upper part of the mountains on the western side of the valley, it contains sulphur minutely disseminated, which gives certain parts a yellowish colour.

On the application of heat, the sulphur is expelled and burns.

The anhydrous gypsum possesses a greater degree of specific gravity than the granular gypsum, and it is harder. The specific gravity of the anhydrous gypsum is from 2.80 to 2.83. Some of it also contains a portion of silex. It is compact, and possesses but a small degree of lustre. Some of the beds are of bluish grey, and others of a brownish red colour.

Besides these, there are beds of white, soft, earthy gypsum, which, I have little doubt, is nothing but the anhydrous gypsum, that,

by exposure to the weather, has combined with water, and passed to the state of common gypsum.

The greater part of the gypsum beds covers the limestone; and where they are soft and earthy, it is difficult to trace the stratification or dip. This has, no doubt, given rise to the opinion of the gypsum being unconformable.

Before I had discovered that the gypsum was regularly interstratified with the schist and limestone, I was led to the belief that it must be so, by observing that the gypsum was spotted with greenish talc or steatite, which was disseminated through all the beds, and that this talc or steatite was of the same nature as the talcous schist which alternated with the limestone; and further, that the limestone was coated with the same steatite; hence I was compelled to admit that the limestone, the gypsum, and the talcous schist, were all members of the same formation. The mountain which ranges along the valley opposite the baths, has its flanks covered with gypsum, which may be observed in various parts lying conformably on the limestone. This mountain is furrowed by torrents, which have

cut a number of deep ravines in it about half a mile or more distant from each other. There is a mule road at a considerable height on the side of the mountain, which is obliged to wind along each of these ravines, and thus affords an opportunity of observing sections of the strata, in different parts. A very large ravine almost immediately above the first bridge, presents the following section of the strata: see annexed cut. —

The strata rise to the north-west, at an angle of about 40°, the lowest beds in this ravine are, —

1. Limestone, which, from an intermixture with talc, is nearly schistose.

2. Talcous schist, with beds of decomposing talc; light green, and very saponaceous.

3. Limestone, coated with talc, and containing irregular laminæ of quartz.

4. Soft earthy gyps.

5. Red anhydrous gyps; sp. gr. 2.83.

6. Grey do.; sp. gr. 2.80.

7. A very thick bed of white earthy gyps, like No. 4., in the middle of which is a black carbonaceous stratum (*a*) about eight inches thick.

These beds are described upwards, from the lowest which was visible. The limestone, (No. 1.) though in thin plates, and intermixed with quartz, was exactly similar to the lower limestone on the lake of Annecy: it was a lightish grey intermixed with red, and highly indurated. The talcous schist (No. 2.) was a thick bed, interstratified with soft talc, which was decomposing and friable, forming a saponaceous powder. The limestone above it (No. 3.) was very highly indurated, from an admixture with quartz; in other respects it resembled No. 1. The soft earthy gyps of No. 4. and No. 7. were similar; they were white, and much intermixed with green talc or steatite. The red and grey anhydrous gypsum (Nos. 5. and 6.) were also spotted with the same.

But the most remarkable circumstance is the occurrence of a thin stratum of carbonaceous matter in the midst of a bed of gypsum, at least thirty feet in thickness. I do not

know that a similar fact, has hitherto been noticed by any geologist. The stratum may be seen for forty or fifty yards, and I have no doubt it extended through the whole bed. From exposure to the weather, it was soft and earthy, like the edges of thin coal strata, that crop out in the coal districts; it was laminar and intermixed with selenite, which injured its combustibility, but it soiled the fingers exactly like coal smut. I have little doubt that it is a part of the series of coal strata (anthracite) that occur in this valley, both near the bottom, and at the height of 3000 feet.

I had now seen sufficient to convince me that the gypsum was regularly interstratified with the other rocks, but ocular proof was still wanting. This I obtained by extending my excursions on the same side of the valley to a ravine about a mile distant from the former, and above the miller's house before described. Here I had the satisfaction of observing a bed of soft earthy gypsum, both red and white, of great thickness, covered by a series of limestone strata, rising to the north-west, at an angle of about 45°, in every respect similar to the limestone under the gyps.

As the limestone was lying regularly, and conformably to the dip of the other limestone in the valley, and was of considerable extent, it cannot be said to be a mass which had slid down. A section of the strata on the east side of the ravine is given in the annexed cut. —

No. 2. Beds of soft earthy gyps, white and red, much intermixed with steatite. The gypsum is inferior in quality to many of the other beds in the valley.

No. 1. Numerous strata of indurated limestone, covering the gyps. The west side of the ravine appears to be talcous schist, intermixed with gyps, which, from its position, must underlay the other.

I brought away specimens of the limestone over the gyps, and of —

Limestone nearly in contact with the gyps, and mixed with steatite.

White gyps next the limestone, much mixed with steatite.

Red earthy gyps.

Though this ravine is not so deep as the former one, and consequently, does not present a section of so many of the strata, sufficient is shewn, to prove that the gypsum of the Tarentaise is regularly interstratified with the limestone; and as this gypsum is saliferous in many parts of the valley, its occurrence will tend to establish the relative age of these formations. Hence we must class the supposed transition-limestones of this district, with limestones of a much later date. The granular common gypsum, higher up in the valley, should, I believe, be regarded as a later member of the series. Mr. Charpentier, superintendant of the mines at Bex, was the first geologist who remarked that the anhydrous gypsum of the Vallois passed into common gypsum by exposure to the weather; but the difference in appearance between the gypsum which has undergone this change, and the highly crystalline granular common gypsum, is very striking, the former being softer, and composed of very minute grains, which give it an earthy appearance. Whe-

ther the continued operation of water may change the internal structure, and render it more crystalline in the lapse of time, I will not pretend to decide. Mr. C. is inclined to believe, that all the gypsum in the Swiss Alps was originally anhydrous. Indeed the occurrence of anhydrous gpysum, intermixed with common gypsum, is a fact of most difficult explanation, unless we admit that the latter has been formed by the action of water upon the former, which in some instances we know to be the case. The formation of anhydrous gypsum itself is one of the great mysteries in geology, and appears utterly irreconcilable with any mode of aqueous precipitation, unless we suppose that after the gypsum was deposited, it became anhydrous, by the expulsion of its water of crystallization, either by the operation of heat, or by some unknown cause: nor would such a supposition be destitute of probability in this part of Savoy, where numerous hot springs indicate the proximity to a focus of subterranean fire, extending under the country, at no great distance from the outer shell of the globe. The beds of gypsum, as well as the limestone, have a very considerable

dip, varying from forty to sixty degrees on the sides of the mountains; and they are often flat at the top, offering incontestible proofs of the mighty convulsions by which the strata have been elevated and depressed. Indeed it is impossible to observe the secondary strata in the Alps, with attention, without being impressed with the conviction, that their position has been changed since the period of their formation.

The grey-wacke in the lower part of the valley is composed of fragments of schistose rocks, imbedded in a very hard flinty base. I have before stated that I did not see this rock in junction with the other formations; but in some parts of Savoy a grey-wacke, nearly similar, rests upon mica slate and talc slate. There is another kind of grey-wacke in the mountains, on the south side of the valley of the Doron, consisting of clay slate, in which particles of quartz are imbedded. I do not consider this rock as properly a grey-wacke, but a true slate, in which the quartz has so far abounded as to form in it distinct grains and concretions, varying in size.

The talcous slate, at the bottom of the valley, under which the hot springs rise,

appears to be placed below all the limestone formations. I could not see its junction with the limestone, but the calcareous strata occur immediately on the opposite side of the river, from which warm springs also arise, that have a lower temperature, owing, doubtless, to intermixture with waters near the surface, as they rise almost on a level with the bed of the river. The talcous slate, immediately above the warm springs, had been recently cut through, and was quite fresh. It was contorted and varied much in its quality; in some parts resembling a purple shining clay slate, with a talcy covering; in other parts it was a bright green, and approached in quality and colour to a soft serpentine. Fragments might have been broken from it, resembling mica slate, into which rock I believe it passes in the upper end of the valley. Masses of Cipoline marble occur at some distance above the talcous slate, in thick irregular beds, but its true position is partly concealed by the soil. It is a dingy white and granular limestone, spotted with lightish green earthy talc or steatite. That this limestone, though similar to what has been called primitive limestone, was of the

same formation with the limestone on the other side of the valley, appears probable, from both containing an intermixture of talc, though this is a lower bed, probably the lowest, that occurs in this part of the Alps. The difference in its colour and structure, as it approaches the great mass of talcous and mica slate, that form the foundation rock of the valley, may perhaps be a fact analogous to that observed by Dr. Maculloch, in the Isle of Sky, where the grey earthy limestone was changed into white granular marble, near its junction with sienite. The beds of anthracite which I examined, in the upper part of the valley, dip towards the valley at a very acute angle. Similar beds occur at a great elevation, and are worked like metallic veins, by galleries at different heights. The rock immediately adjoining the coal is a dark carbonaceous schist, with particles of mica, and where the mica increases in quantity, it resembles a dark micaceous sandstone. This schist seems to pass by gradation into a true mica slate, in which rock the beds of coal occur, above the village of Villard Goitrou. I did not observe any vegetable impressions in the schist containing the

coal, but I saw specimens from other mines in this district, of vegetable impressions of ferns, similar to those in the regular coal strata, imbedded in a slate which exactly resembled the silvery killas of Cornwall, and may be regarded as intermediate between mica slate and clay slate, but it had more of the character of the former. Impressions, supposed to be of reeds, also occur in this slate with the coal. Coal is likewise found on the south side of the mountains that separate the Tarentaise from Piedmont ; and in the Alps of Dauphiny, adjoining the Tarentaise, Anthracite, with slate containing vegetable impressions, rests immediately on what are called primitive rocks. At the Col de Balme, near Chamouny, I obtained a large impression of fern, in a slaty sandstone, so micaceous, that it might be called brilliant mica slate, into which rock I have little doubt that it passes.

It cannot be proved that the coal in this part of Savoy is of more ancient date than the coal of South Wales or of England, by its containing no bitumen, for much of the Welsh coal is also without bitumen, and is as pure an anthracite as any in the Alps ; and it has not, and I believe it cannot be shown

that the vegetable impressions accompanying the Alpine anthracite, are more ancient than those found in the regular coal-strata in England. The occurrence of bituminous coal, and anthracite, in the same beds in England, proves that the absence of bitumen can determine nothing respecting the relative antiquity of different kinds of coal. M. Von. Buch has observed even granite covering coal in Norway; therefore, instead of asserting that the anthracite of Savoy is very ancient, because it is associated with mica slate, may we not with equal probability assert, that the mica-slate is comparatively recent, because it covers coal and schist, in which are vegetable impressions?

There is a striking similarity between the structure of the anthracite from the mica-slate, and that of the carbonaceous matter in the gypsum, before described in the lower part of the valley. This would tend to confirm the opinion, that they were both allied, as members of a continued formation.

M. Brogniart has truly observed that the ancient primitive granite, of which former geologists speak, *appears* to exist

only in countries that have not yet been examined, which is nearly the same as declaring its existence to be imaginary; indeed, if the granite of the Alps, be not primitive, it is in vain to seek for a primitive formation of this rock, in any part of the world.

Whatever may be the period at which the granite of the Alps was formed, it may be proved by decisive facts, that it did not acquire its present position, till after the formation of the secondary calcareous strata, by which it is covered. These facts will be referred to in some of the succeeding chapters. Mon. Daubuison has asserted, that the granite of the Alps acquired its present position soon after the date of its formation. This is merely an assertion; were it proved, we could have no doubt that the granite was of posterior date to the limestone, as I shall endeavour to show hereafter. In the present state of our knowledge, I am inclined to think that system of geology is most consistent with existing appearances, which maintains that granite has been formed from the fusion of pre-existing rocks, and was thrown up and crystallized subsequent to the deposition

of many of the strata called secondary. Nor does it seem improbable, that granite may again be formed, by the fusion and crystallization of secondary strata, at some future revolution of the globe; for our coal strata, with the shale and silicious sandstone, contain together the elements of granite, gneiss, mica slate, and clay slate. The latter, Daubuison found identical in its composition with coal shale, except that it contained less carbon.* Were the secondary strata to remain by any cause in a state of perfect fusion, for a sufficient length of time to admit the formation of new compounds, by elective attraction and crystalline polarity, nothing further would seem required for the formation of all the mineral substances of which primary rocks are composed. Whatever objections may rest against this theory, it does not present such opposition to the known laws of nature, as that which supposes granite rocks to have been deposited by aqueous precipi-

* Coal shale.

Silex	48
Alumine	23
Potass	4.7
Magnesia	1.6

together with iron manganese and carbon.

tations. We know that crystals of felspar are formed in lavas, but we know nothing analagous to the formation of a crystal of felspar by water. Independently of all theoretical systems, the relative position of the granite of the Alps, is an important geological fact, to which I shall have occasion to refer more particularly in some of the following chapters.

CHAP. IX.

ON THE AGRICULTURE OF SAVOY.

About one hundred years since, the land of Savoy was measured, and registered in an office called *le Cadastre.* The land was divided into three classes, as land of the first, the second, and the third quality; the part covered by forests, glaciers, rocks, rivers, and roads, in each commune, was also measured or estimated. It will be easily understood, that the situation of land, whether on the north or south side of a mountain, and its elevation and facility of access, are more certain indications of its value, in an alpine country like Savoy, than the nature of the soil itself. A land-tax rated according to the three different qualities of land, was at the same time imposed, and is continued. At present this tax is levied monthly.

There is also another office called *Droit de Régistrement*, where the names of the proprietors, and the limits of their estates

are registered. At this office, a fine of one *per cent.* is levied, on the transfer of estates to collateral heirs; the fine is paid when they take possession, by the enregisterment of their names at the office. The fine on the purchase of an estate is four *per cent.*, but in poor countries like Savoy, few purchases of land are made. Indeed I was informed that the number of contracts for the purchase of land in each year is greater in the little canton of Geneva, than in the whole of Savoy.

During the short period of the prosperity of Savoy, when the Dutchy was united to France, there was a third office for mortgages, called *Hypothèque*, but on the restoration of the King of Sardinia to the dukedom of Savoy, many of the nobles being in debt, had the influence to get this office abolished, in order to prevent the situation of their affairs from being exposed.

It is truly surprising that a register-office like the *Droit de Registrement*, comprising the register of mortgages also, is not established in every county in England. At present, it is only a part of Yorkshire and Middlesex where any office of the kind for freehold property exists, and even there

the benefit is much lessened by the brevity of the notice, which, in cases of mortgages, leaves unexplained the nature and amount of the transaction. Of all the methods of levying money on landed proprietors or mortgagees, that which secures to them the undisputed right to their property, would be paid the most cheerfully. Foreigners can scarcely believe that our landed proprietors are content to remain without the security which a public register would give to their titles, or that men can be found who are willing to lend money on mortgage, where this clear security cannot be obtained.

In most parts of Savoy, the land is divided into very small farms, and is occupied by the proprietors or paysans, who live in an exceedingly frugal manner, and cultivate the ground with the assistance of their wives and children; — for in Savoy, as in many other parts of Europe, the women do nearly as much field labour as the men.

In the neighbourhood of towns, the land is chiefly the property of the rich, who let it on certain conditions, which derive their origin from feudal institutions,

and were formerly prevalent all over Europe, and have not entirely ceased in some parts of Great Britain. These conditions I shall briefly state in the form of answers to questions which I wrote down and gave to three intelligent proprietors in the agricultural parts of Savoy, who had no connection with each other. The answers which they returned in writing were, in substance, nearly the same; I may therefore presume that they are correct.

Some of the ancient nobility also possess lands in Savoy, that are let on similar terms. The lands belonging to the monasteries were sold during the French Revolution, when Savoy was annexed to France. The gradual abolition of the monasteries had been begun by the old government of Sardinia before the Revolution, for the monks were prohibited from receiving any new brethren into their establishments, in order that the estates might devolve to the crown, on the extinction of the different fraternities. This measure, though wise in the abstract, was not unattended with inconvenience, and perhaps we may add, injustice. The poor, who had been accustomed to fly to the monasteries for relief in cases

of distress, were left without any support, except the casual charity of their neighbours, who had little to spare from their own absolute necessities. The situation of the poor is therefore much worse in Savoy, than before the abolition of the monasteries. The poor in England suffered in the same manner on the abolition of the monasteries in the reigns of Henry VIII. and Elizabeth, before the poor's rates were enacted.

On the establishment of tithes in England, they were expressly stated to be for the maintainance of the clergy and the poor. Such I suppose to have been the case in other countries; but the rich regular clergy, have long since forgotten the claims of the poor to a portion of the tithes, and abandoned them to the care of the monks. On the lay appropriation of the revenues of the monasteries, the poor found no defenders to enquire into the original intentions of the founders, or to assert their claim to a portion of the property.

The charity of the monks of Savoy lost much of its usefulness by the indiscriminate manner in which it was generally bestowed: certain days and hours were ap-

pointed at each monastery for the distribution of provisions, and the indolent were thereby enabled to support themselves during the whole week, by walking to the different monasteries on the days of donation. This was offering a premium to idleness, and was the means of increasing the number of mendicants, which will in every country, be proportionate to the facility of obtaining food without labour.

Though the peasantry in Savoy are very poor, they cannot be called miserable. In the neighbourhood of towns, their situation is worse than at a distance, and not far from Chamberry, I have seen a few families, that might almost vie in squalid misery, rags, and filth with the poor of Ireland *: but the general appearance of the peasantry is respectable.

The following summary of the answers to the three series of questions I proposed, relating to the agriculture of Savoy, will be sufficiently explanatory of the nature of the questions; I have not therefore thought it necessary to enlarge the work by stating them.

* I speak of the poor in Ireland as I saw them in the vicinity of Dublin in the year 1813.

The measure of land called *un journal* in Savoy, contains 400 square toises, of eight pieds du roi each, equal to about nine English feet. The journal is therefore almost exactly the same, as three-fourths of an English square acre.

The price *per* journal of land of the first quality in the vicinity of towns, is from 700 to 900 francs, — depending on the situation.

Of the second quality, from 500 to 700.

Of the third quality, from 300 to 500.

In the communes more remote from towns, the medium price of land of the three qualities, ranges from 200 to 600 francs.

The meadows, which are seldom watered, are almost always classed with the second quality of land.

In Savoy there are four modes of occupying land for cultivation — 1st. by the proprietors; 2d. by farmers; 3d. by grangers; and 4th. by tacheurs. The three latter modes differ much from the established forms of occupancy in England, though, as I have mentioned before, some traces of them exist, or did exist, till lately, in the northern parts of our island.

1st. Land very near to towns is generally cultivated by the proprietors, who either keep cattle, or take them in to graze at so much *per* head.

2d. By farming land, is understood, letting it at a fixed rent, to be paid according to the value of the produce, taken at an average of ten years.

3d. By grangers, or renting land *à moitié fruit*, is understood, that the proprietor takes half of all the grain and fruit, half the produce or increase of the cows, half the eggs, and in short, half of every thing which is productive. But if the land be distant from the proprietor, he contents himself with taking half the grain of every kind, and is paid from ten to sixteen francs for each cow; a dozen eggs for every hen; and from two to three louis for a boar and sow; vines and hemp are always rated at half. When the land is only two or three leagues distant from the residence of the proprietor, he endeavours to let his land *à moitié*, in preference to farming it, because he may avail himself of the most favourable opportunity for selling the produce; hence he has an advantage of twenty *per cent.*, and a more easy superintendance

of his property, than when the land is farmed.

When the land is farmed, the farmer pays the taxes or not, according to agreement. When the land is let *à moitié*, the proprietor pays the taxes, and the granger finds seed for his portion, if the land be good; but if the land be indifferent, the proprietor finds seed for the whole, and pays only half the taxes, except the war taxes, which are paid by the proprietor, unless there be an express stipulation to the contrary.

4th. There is another mode of cultivating land, in the immediate vicinity of towns. The proprietors, to avoid keeping too many servants in their own houses, place a father of a family in the house upon the farm. This man is called *le Tacheur*: he takes care of the cows, for half their produce: he ploughs the ground, receiving for every pair of oxen employed, or for three horses, from seventy to eighty francs *per annum:* he has half the wine: the share he receives of the wheat and grain is in the proportion of two parts for every nine taken by the proprietor. The latter pays all the taxes, and keeps the accounts.

The tacheur may be changed every year: when he is employed in repairing fences, &c. he is paid by the day; this is always undertaken when he enters the farm.

The leases granted to the farmers and grangers are on terms of three, six, or nine years; but when the leases are for six or nine years, a reservation is always made, that at the expiration of every three years the proprietor may revoke the lease, by giving three months' notice, if he be not satisfied with the tenant. The proprietor always supplies the farmer or granger with a sum of money, without interest, called "*chaptal*," (capital,) to aid him in buying oxen; for a farm of two oxen it is generally about twenty louis; for a farm of four oxen, forty louis, and so on. The proprietor, for this sum, has an exclusive right to seize the cattle of the farmer, should he sell them clandestinely. When the land is let *à moitié fruit*, the proprietor finds a man to thrash the corn, whose wages he pays; but the thrasher is kept by the granger. It is the same for the repairs of the buildings, &c.

The annual wages of a farming man varies from three to six louis. A day-

labourer receives from twenty-five to thirty sous, or from one shilling to fifteen-pence English, per day, if he keeps himself; or from ten to fifteen sous, (or five-pence to seven-pence halfpenny,) if he is fed; but these wages vary according to the season. A carpenter or wheelwright receives forty sous per day, or twenty sous if he is fed. The price of a pair of oxen, for agriculture, varies with the nature of the soil. Near Rumilly it is from eighteen to twenty-five louis; but three leagues nearer Geneva the land is stiffer, and requires stronger oxen for the plough, and a consequent augmentation in the size and price. The price of a horse, for agriculture, is from twelve to twenty louis, and of a mule from ten to fifteen louis.

Having learnt the price of labour in various parts of Savoy, I proposed the following question: Is it possible for a labourer, with a family, to procure a sufficient quantity of wholesome food for their consumption? One of the answers was, *Cela est très-facile*, "It is very easy;" the other was, "The labourer lives very frugally," *très-sobrement*. "In general he eats very coarse, but wholesome, bread, and except

in the mountains, he eats very little meat, and rarely drinks wine, but he has a great resource in potatoes.

The wages of female servants in those families that are sufficiently opulent to keep them, are from fifty to sixty francs, or from forty-two to about fifty-two shillings a year, but in some cases they are as high as seventy-two francs, or three pounds. The wages of a cook are from 100 to 120 francs. In the year 1821, when the above answers were given me, the price of provisions in Savoy were as under.

Wheat, 120 lbs., of 18 oz., fifteen to sixteen francs, viz. twelve shillings and six-pence to thirteen shillings and four-pence English. Beef, three-pence to four-pence; mutton and veal, two-pence halfpenny to three-pence halfpenny; pork, four-pence to five-pence.

According to this statement, one day's labour of a farming man, would purchase about twelve pounds, avoirdupois, of wheat, or from four to five pounds of beef, veal, or mutton; but these are dainties which he rarely tastes. Potatoes, rye-bread, chesnuts, and milk, form the principal part of

the food of the poor. The day-labourer in Savoy has to deduct, from the amount of his labour, about seventy days in the year, including saint-days and Sundays, on which he receives no wages. During part of the winter months, also, he is without employment, or is obliged to work at reduced wages. It is well known that the quantity of animal food consumed in the families of those who may be considered rich, is much smaller in the southern parts of Europe than in England; but to prove that meat is considered rather as a delicacy than as a common article of food, I was told that in Savoy, when female domestics are hired, it is not uncommon to stipulate, that they should not eat any of the meat that came from their master's table, as they are only allowed soup and vegetables.

The above observations apply principally to the western and more level and fertile parts of Savoy, in the neighbourhood of Chamberry, Rumilly, Aix, and Annecy. In these parts, agriculture had made a considerable progress during the last twenty-five years; but since Savoy has been reunited to the government of Sardinia, the

motives for improvement are withdrawn, as the Savoyards are deprived of a free market for their produce in France and Switzerland, and the Alps oppose a barrier to a free intercourse with Italy, or to the sale of produce, except for mules and cattle, and these are taxed by the government on leaving Savoy.

The inhabitants of the mountains are richer and more industrious than those of the plains, the land being chiefly occupied by the proprietors; and those who are tenants occupy on more liberal terms than in the neighbourhood of towns. The riches of a mountain peasant, are estimated by the number of cows he can keep during the winter. An old peasant from the mountains at the head of the lake of Annecy, was pointed out to me as remarkably rich; he kept twenty-five cows. This implied that he had a quantity of land in cultivation, sufficient to supply them with fodder during the winter months, when they are kept entirely in stables.

The description given by Saussure of the mode of pasturage in Chamouny will apply with little variation to all the alpine communes in Savoy. "The rich peasants in

the Alps possess meadows, and even habitations* at different heights. In winter they live in the bottom of the valley, but they quit it in the spring, and ascend gradually, as the heat pushes out vegetation. In autumn they descend by the same gradations. Those who are less rich have a resource in the common pastures, to which they send a number of cows, proportionate to their resources, and their means of keeping them during the winter. The poor, who have no meadows to supply fodder for the winter, cannot avail themselves of this advantage. Eight days after the cows have been driven up into the common pasture, all the owners assemble, and the quantity of milk from each cow is weighed. The same operation is repeated one day in the middle of the summer, and at the end of the season, the quantity of cheese and butter is divided, according to the quantity of milk each cow yielded on the days of trial."

* There are chalets, or public dairies near the mountain pastures in Savoy, as well as in Switzerland; persons reside in these chalets during the summer months, to make cheese and butter. In many situations it is the labour of a day to ascend to these chalets, and return to the valleys immediately below them.

There are also public dairies in some of the villages, where the poorer peasants may bring all the milk they can spare, from the daily consumption of their families. The milk is measured, and an account kept of it, and at the end of the season the due portion of cheese is allotted to each, after a small deduction for the expence of making.

No large flocks of sheep are kept in Savoy, as it is necessary to house them during the winter, at which time they are principally fed with dried leaves of trees, collected during the autumn. Many poor families keep a few sheep to supply them with wool for their domestic use. These little flocks are driven home every evening, and are almost always accompanied by a goat, a cow, a pig, or an ass, and followed by a young girl spinning with a distaff. As they wind down the lower slopes of the mountains, they form the most picturesque groups for the pencil of the painter, and carry back the imagination to the ages of pastoral simplicity sung by Theocritus and Virgil.

The vineyards in Savoy are cultivated for half the produce of the wine. The

cultivator pays the whole expence, except the taxes, which are paid by the proprietor.

Walnut-trees, of immense size and great beauty, enrich the scenery of Savoy, and supply sufficient oil for the consumption of the inhabitants, and for the adjoining canton of Geneva. Walnuts have been called the olive of the country. The trees belong principally to the larger proprietors. They are planted by nature, being scattered over the fields, and in the woods and hedge-rows, intermixed with chesnut and forest trees of various kinds. The walnut harvest has been already described. Sixty pounds of kernel, of 24 oz., equal to 90 lb. avoirdupois, I was informed by M. Berthel, yield from 20 to 24 quart bottles of oil.

Tobacco, which is much used in Savoy, was cultivated with success in the neighbourhood of Rumilly; but on the restoration of the old despotism its culture was prohibited, and the implements of manufacture seized. This was done to increase the revenue that the king derives from the sale of tobacco. So strict are the officers of the douane respecting the introduction of this article, that a Genevese lady had

her carriage and horses seized between Geneva and Annecy, because her coachman had brought with him a pound of tobacco for his own use.

The agriculture of Savoy will be regarded as in a low state of improvement, if the answers I received respecting the average quantity of the produce be correct. One of the answers stated the average increase of wheat to be from three to five on the quantity sown, and near the towns from five to seven. Another agriculturist stated the average increase on the best lands to be nine, and in the neighbourhood of Annecy thirteen fold. One part of Savoy is, perhaps, the finest corn land in Europe; and the very heavy crops I saw in the neighbourhood of Aix and Annecy, made me doubt the accuracy of the above statements. But on referring to Arthur Young's account of the agriculture of France, before the revolution, I find it stated, that four and a half was regarded as the average increase in that country, which is very similar in climate to Savoy.—Since that period, the agriculture of France has greatly improved. The culture of artificial grasses is spreading in Savoy, but it

is not yet very general. In the neighbourhood of Aix, Rumilly, and Annecy, wheat is succeeded by rye. The rye harvest being over in June, they immediately sow the land with buck wheat (*sarrasin*), which is cut in September; the following year the land is sown with spring corn.

The grass lands are always mown twice, and the latter mowing is sufficiently early to allow a good pasturage in the autumn.

I found it difficult to obtain a correct account of the amount of direct taxes. They are two kinds, the king's taxes, and the taxes for the communes for the roads, clergy, and local charges. The tax on land of the first quality is 44 sous*; for land of the second and third quality, much less. There is also a capitation tax, a tax on stock and furniture, stated to be proportioned to the supposed ability of the individual, and of course subject to much inequality or injustice, under a despotic government. The cattle and mules are subject to a further tax, when they leave the territory. The government levies a duty on every article that is imported, and on al-

* Per Journal.

most every article that is sent out of the country. The farmers are also subject to corvées, that are sometimes very oppressive. But though the amount of taxes now paid in Savoy is three times more than before the revolution, they are collected with greater facility, and are less felt than formerly; for during the time that Savoy was united to France, the inhabitants increased in wealth, and the abolition of tythes and seignioral rights relieved them from burdens, far more intolerable than those of an increased taxation. These rights, or rather wrongs, the government has not attempted to restore. Indeed, before the revolution, a system had been organised for their redemption at a stipulated price, and some of the landed proprietors had already purchased their freedom, when the French took possession of the country, and swept away at once the whole of their accumulated oppressions.

Notwithstanding the imperfect state of agriculture, a considerable quantity of wheat is exported from Savoy to Geneva, and the Pays de Vaud. I have seen one statement which made the exports before the revolution amount to 130,000 sacks of wheat, and

as many of other grain. But the principal exports are cattle, and mules bred upon the mountains, with hides, cheese, and barrelled butter. A great number of the cattle are sent into Piedmont or to Geneva. Twenty-five thousand head of cattle are sold annually to the butchers of Turin. Were due encouragement given to agriculture, and a free market opened, Savoy might supply four times the quantity of its present amount of produce.

CHAP. IX.

ANNECY TO THE BATHS OF SAINT GERVAISE. — DESCRIPTION OF THE BATHS. — OBSERVATIONS ON THE NUMEROUS THERMAL SPRINGS IN THE CENTRAL RANGE OF THE ALPS. — THEIR GEOLOGICAL POSITION. — INFERENCES. — MOUNTAINS NEAR SERVOS. — PROGRESSIVE MOVEMENT OF THE GLACIERS. — ARRIVAL AT CHAMOUNY.

The valley of Chamouny has been so frequently described, and a part of its geology has been so fully examined by Saussure, that I shall principally confine my remarks to those facts which are less known, and which open new views respecting the secondary strata in this part of Savoy. I shall also have to call in question the generally received opinion, respecting the great relative antiquity of nearly all the strata covering the granitic rocks of the Pennine Alps.

The river Arve, which rises on the western foot of the Col de Balme, one of the

mountains that divide Savoy from the Haut Vallois, passes along the valley of Chamouny, and then turning northward, escapes through a vast chasm to Pont Pelissier, and pursues its course in a north-westerly direction, till it joins the Rhone, nearly under the walls of Geneva. The whole length of the Arve, from its rise to its junction with the Rhone, is little more than seventy-five miles. It is along the valley of the Arve that the road to Chamouny from Geneva is carried. As far as the town of Sallenches, a distance of nearly forty miles, the road is perfectly safe for carriages of every description, and is much travelled in summer, not only by tourists to Chamouny, but by company going to the baths of St. Gervaise, three miles beyond Sallenches. On leaving Geneva, Mont Blanc and some of the Aguilles of Chamouny are seen towering over the intervening mountains; but they soon disappear in advancing, and are not seen again till the traveller arrives at St. Martin, a distance of forty miles, when having passed a range of mountains that overhang the road on the left, Mont Blanc once more

presents itself as a shapeless and enormous mass of

"Snows piled on snows, amazing to the skies."
THOMSON.

We did not commence our tour from Geneva, but from Annecy, along a new and very fine road, which is making from Annecy to Bonneville.

The country is rich and beautiful, but presents few striking objects, except the mountains we had left on the Lake of Annecy, which are here seen in profile. The Lake of Annecy has evidently extended much farther in this direction. A bed of gravel of vast thickness, which is cut through by a river on the south of the road, was once, in all probability, covered by the waters of the lake. We continued to ascend gradually for several hours, until we had reached the summit of a pass through the mountains, that form the western boundary of the valley of the Arve, whence we began to descend towards Bonneville. The road passes through a considerable mountain-town, called La Roche, which overlooks the valley, from

the Lake of Geneva to Cluse. La Roche was formerly fortified, but was surprised and taken by the Genevese in 1590, and a great slaughter of the inhabitants followed. The Genevese defaced the emblems of the Catholic faith in the churches, and returned laden with pillage, to offer thanks for the pious work they had been enabled to perform. The appearance of Bonneville is imposing on approaching it from La Roche; it seems a city of considerable consequence, in the midst of a wide cultivated plain, bounded by lofty mountains. Bonneville contains about 1000 inhabitants. It is much better built than most of the towns of Savoy; the market-place and main street are very broad, and the houses in the environs are surrounded by gardens and plantations of poplars, and other trees.

I visited the quarries of micaceous sandstone, near Bonneville, in which are sometimes found vegetable impressions, more or less carbonized. These strata, though they have been considered as parasitical, are evidently subordinate to the great calcareous formations in this part of Savoy. The mountains in the whole of this valley, as far as St. Martin, are calcareous, with sub-

ordinate beds of sandstone and soft schist. They every where present indications of a stratification, which has undergone extraordinary disturbances, here vertical, there curved, or dipping to opposite sides of the compass, in the same mountain. In another part, the strata are nearly horizontal, or dip very gently. The range or direction of the strata is also variable. There is another circumstance which has been but little attended to, that greatly increases the apparent irregularity of the strata, and by an optical illusion presents them sometimes as in a state of extraordinary confusion; for according as the escarpements and ravines in these mountains, cut the curved stratification irregularly in different directions, either approaching the line of dip, or the line of bearing, the strata appear twisted in almost every direction, when in reality they are segments of one curve. Added to the above, the cleavages on a large scale are often as regular as the strata themselves, and can scarcely be distinguished from them; and as these cleavages intersect the strata nearly at right angles, this has also led to many erroneous conclusions, respecting the stratification of the

calcareous mountains in this part of Savoy, some of which I intend afterwards to notice.

The valley of the Arve continued wide till we approached the town of Cluse, when the rocks advance on each side, leaving but a narrow passage for the river and the road. The rock at Cluse is a dark limestone, bearing a resemblance to lias, which it may probably be: the workmen informed me it contained shells, but I could not procure any. These shells are ammonites, turrilites, and what have been called orthoceratites, though they are most probably encrinal remains, as they are described as articulated, and ramified in arborizations. Beyond Cluse there is a brown limestone, and a dark-veined limestone. The valley beyond Cluse is narrow and winding, and presents some features of striking beauty. The cavern of Balme and the cascade of Maghlans are the objects that most attract the attention of travellers. The cavern would scarcely repay any one for the labour of the ascent, who has seen the caverns in Derbyshire, and the West Riding of Yorkshire. The cascade is more remarkable for its height than for its beauty; it falls over a broad face of naked rock, 858 feet above

the road. This rock has been particularly described by Saussure, as a remarkable instance of horizontal strata, bent upwards, and then curving backwards, and resting against other strata, nearly horizontal. After examining with attention for an hour the course of the strata from the road, I left the place, much inclined to believe, that what M. Saussure regards as stratification, is merely an illusion produced by the cleavage; but I determined to examine it more fully on my return. In advancing towards Sallenches, the road passes through the lower part of the great calcareous formations of Savoy. It consists of a vast thickness of a dark argillaceous limestone, in very thin strata, alternating with thicker beds of grey limestone. * Near St. Martin, beds of dark bituminous and argillaceous schist, make their appearance under the mountain on the left, called the Aguille de Varons; this terminates a band of calcareous strata, 100 miles in breadth. At St. Martin the river turns more west-

* In the Swiss Alps, this limestone is frequently combined with such a large portion of argillaceous and siliceous earth, as nearly to approach to the character of hornstone.

wardly, and the valley opens out to a great width. Here Mont Blanc bursts on the view, filling up a large space of the southern horizon.

We dined at Sallenches, and then visited the baths of St. Gervaise, which are at present much frequented in the summer, chiefly by invalids. I do not know that a description of these baths has been given by any English traveller, as they lie out of the direct road to Chamouny, and for want of proper accommodations, have only been resorted to very recently, though the spring was discovered in the last century.

The road to the baths from Sallenches is along the valley of the Arve, leaving that river on the left. The town of St. Gervaise is situated on an eminence, at the entrance of the mountain-valley of Mont Joy, (anciently *Mons Jovis*) along which there is a mule-path that conducts over the Col de Bon Homme, and the Col de Seigne, to Cormayeur in Piedmont, descending under the southern escarpements of Mont Blanc.

The baths of St. Gervaise are situated in a deep ravine below the town of St. Gervaise. This ravine is about half a mile in

length, and 300 yards in width at its entrance, but it grows narrower as you advance, and terminates in the bed of an impetuous cataract. The baths are situated a little below the cataract, at the farther end of the ravine. The scenery is savage and sombre, or what might be truly called *triste*. On the rocks which overhang the ravine, there are a few pine trees, which rather add to the melancholy of the site. The torrent which descends into the ravine forms a cascade, but owing to the projecting rocks on the south, it is not seen until you have passed the baths. There is a long low wooden house with small windows, facing the entrance of the ravine, which has a very singular appearance, and it would not be easy to conjecture at first sight, for what purpose it could possibly be placed there: this is the house for the reception of the company. We were fortunate in meeting our friend, Mr. B., immediately on entering the ravine. He had been staying at the baths some weeks, and was so obliging as to accompany us to examine the place. The inside of the boarding-house has exactly the appearance of the inside of a man of war, with windows

in the port-holes; the roof, floors, and sides, were all of unpainted wood; eighty persons had sat down to dinner in the long room, which was low and gloomy. The lodging rooms also resembled the little cabins in a ship; added to this, the valley is so damp, from the vapour of the hot springs, and the mist from the cataract, that a piece of glue, with which Mr. B. used to fix his drawing paper, became in a few days as soft as if it had been soaked in water, even in that dry climate, and in the middle of summer. There needed no other hygrometer, to prove how fully the air was saturated with moisture. There is no small difficulty in procuring suitable provisions, to supply the table for a large company in this sequestered part of the Alps. What then can be the inducement to remain at St. Gervaise? certainly it cannot be pleasure, but health. The waters of the baths of St. Gervaise may be briefly and clearly described; they have all the qualities of Harrowgate water in full strength, combined with a temperature approaching to those of Bath. It is therefore evident, that they must be of potent efficacy in many cutane-

ous diseases; and it is for the cure of such diseases that they are chiefly resorted to.

Beside the Swiss and the Savoyards, strangers from distant parts of Europe begin to visit the baths of St. Gervaise. The Duke and Duchess of Wurtemberg were there at the time we stopped.

The spring issues from the bottom of the rock, behind the house. The rock has been excavated to open and secure the source, which supplies five or six baths, but is not nearly so abundant as either of the springs at Aix, in Savoy.

My principal object of examination was the rock from whence the water rises. It is a talcy mica slate, in junction with limestone, like that of Brida, in the Tarentaise, though here it has more the appearance of true mica slate. The limestone is coated with mica slate, and may therefore be regarded as connected with it. This is probably the lowest of the calcareous beds that cover the granitic rocks, and is even below the dark argillaceous schist, which appears on the other side of the ravine, and on the road from Sallenches to St. Gervaise. This limestone resembles in character many of the limestones in the upper part of the

great calcareous formation, and could not be distinguished from it in hand specimens. At the entrance of the ravine, there is a bed of reddish siliceous sandstone, or what might be called quartz rock, without impropriety, which passes into a state nearly resembling jasper; it is intermixed with steatite. There is also gypsum, similar to some of that in the valley of Brida, described Chap. VIII. The short stay I made here did not admit of my examining its relation with the other rocks, but from its analogy of character and position with the gypsum of Brida, I have little doubt but that it belongs to the same formation.

I had now visited all the principal known thermal waters on the northern side of the Grecian and Pennine Alps, except those of Leuk, the position of which I had only observed at a distance from below Leuk. The thermal waters are those of Brieg, or Naters, of Leuk, and of Bagnes, in the Canton of Vallois, near Martigny; the latter were once much frequented, till covered by an eboulement in the 16th century. Also the thermal waters of St. Gervaise, of Aix les Bains, and of Brida, and Moutiers, in the Tarentaise. There is another spring, said to

have a very high temperature, under a rock, called la Saute de Pucelle, west of the road from Moutiers to Bourg St. Maurice, in the Tarentaise. It is probable that many other thermal springs are at present covered by eboulements.

Numerous as are the hot springs on the northern side of the central range, and, as will be seen, on the southern side also, it is a little remarkable, that they have hitherto been regarded entirely as insulated phenomena; and philosophers have invariably asserted, that there are no indications of the operations of subterranean fire in the Alps.

There is one circumstance in which all these thermal waters agree; they rise near the bottom of the great calcareous formation, that covers the northern side of the Alps, and near its junction with the mica or talc slate, that covers the granite. I do not know that this fact has been noticed by former observers, but it is truly remarkable. In three of these, viz. the baths of Brida, of St. Gervaise, and of Naters, the springs are in immediate proximity to, and in contact with, the mica slate; and in the others, it is evidently not far distant.

At Moutiers, the mica slate, or dark schist, into which it passes, is not seen at the spring; but the other side of the valley is dark schist, and by tracing the calcareous rock from the ravine in which the hot saline waters rise, up the valley of the Doron to Brida, it will be found that the limestone which covers the hot saline spring, is one of the lowest beds; and at Brida, where the rock has been cut through, to give a free passage for the warm spring, the excavation has been made in talcy mica slate; while on the opposite side of the river, where the rock has not been removed, there is a warm spring, rising from under limestone. This spring has a lower temperature than that which rises in the mica slate, owing, no doubt, to a greater admixture with the waters near the surface.

The hot springs at Aix have the highest temperature, and are also the most abundant of the thermal waters of Savoy, for they not only form two considerable streams, but in the immediate vicinity of Aix, and also at the distance of one or two miles from the baths, warm springs issue from the ground, and only require to be separated from the surface water, to be of as high a

temperature as the springs now in use; but the government will not permit other baths to be opened. The hot springs at Aix rise at the foot of a calcareous mountain, which is from 3000 to 4000 feet high. This might fairly induce the belief, that they rise near the bottom of this limestone formation; but a more satisfactory proof may be obtained, by tracing (as I have done twice) the range of these mountains in a south-easterly direction, to where the lowest beds terminate. The mountain extends from Aix to near Chamberry, Mont Chaparillon being a part of the range. Proceeding to the south-east, the termination of the limestone may be observed; its lowest beds forming on the mountains north of the Isere, isolated caps, which cease before reaching L'Hopital and Conflans, where the foundation rock is mica slate.

No one who has seen the position of the baths of Leuk can doubt that the springs rise near the bottom of the lowest beds of limestone in that part of the Alps, being situated in the bottom of an immense ravine; and in ascending the valley of the Rhone, the mica-slate, or dark schist, on

which the limestone reposes, may be seen on the same side of the river.

The hot springs of Naters, as I have before mentioned, rise in mica slate, on the same side of the valley, and a few miles above the gorge, where the springs of Leuk rise. Though the springs are called the springs of Naters, they are three miles lower down the valley. A section which has been made into the granitic formations by the Rhone, near Martigny, at the celebrated cascade of the *Pisse Vache*, shows how near the lower calcareous rocks in the valley of the Rhone are to those called primitive, though the granitic formations are not seen again in the valley, till after passing the town of Leuk. Now the inference which may fairly be drawn from these observations is, that the thermal waters of the Alps, do not rise in the upper strata, but spring out of the lower and primary rocks; and as they break out near the feet of the great range of the Alps, and extend from the northern side of the Semplon, through Savoy, to the confines of France, and even into Dauphiny, in nearly the same direction, we

may with some probability infer also, that these mountains are placed over or near to one common source of heat, to the agency of which they may owe their original elevation. This latter inference is, in some degree, supported by the well-attested fact, that the districts in which the hot springs are situated, have been subject to great and frequent convulsions, particularly the Haut Vallais, where the temperature of the water is the highest. In the year 1755, at Brieg, Naters, and Leuk, the earth was agitated with earthquakes every day from the 1st of November to the 27th of February, and some of the shocks were so violent, that the steeples of the churches were thrown down, the walls were split, and many houses were rendered uninhabitable. Many of the springs were dried up, and the waters of the Rhone were observed to boil. At three different times the inhabitants abandoned their houses, and fled for safety into the country. We were informed by a physician at Brieg, who accompanied us to the baths of Naters, that, at the same period, the rocks above the spring opened, and threw out a considerable quantity of hot water.

On the southern side of the central range of the Grecian and Pennine Alps, there are also numerous warm springs. The best known are those of St. Didier, near Cormayeur, almost immediately under the southern escarpement of Mont Blanc. The warmest spring at Cormayeur has the temperature of 94° Farenheit. I have before mentioned that I was prevented by the weather from visiting these baths, when I had arrived at the foot of the little St. Bernard. I am informed that several of the retired valleys in Piedmont, at the foot of the central range, are subject to earthquakes, during which the earth has opened, or sunk down in various parts, though these effects have been too local, to excite attention at a distance.

With these facts before us, it seems most unreasonable to doubt, that the hot springs in the Alps owe their temperature to subterranean fire, as much as those near Naples, or in Auvergne, or the Geysers in Iceland, though the earth may no where have thrown out lava in their vicinity.

That subterranean heat produces sensible effects at a distance from the thermal waters, may, I think, be fairly inferred

from the observation of Saussure, on the thawing of the bottom of the glaciers during seasons of intense frost. This cannot be owing to the effects of the mean temperature of the earth, as some have supposed, for were it so, we should observe the earth thawing the ice in other situations, and as the ground under the glaciers has, from unknown ages, been shielded from the solar rays, it must consequently derive less heat from that source, than any other parts of the earth's surface.

The constant occurrence of thermal springs in deep valleys, near where the rocks called primary are covered by the secondary strata, will, I think, admit of a satisfactory explanation. The granitic rocks and those of mica-slate are intersected by so many fissures, that the thermal waters could not rise through them to any great height above the valleys, where these rocks are uncovered; and even were they to rise above them, they would be so intermixed with surface-waters, that their temperature would be reduced to that of rain water. But where the primary rocks are protected more or less from the surface-waters, by a great thickness of secondary

strata, some of which are nearly impervious to water, there the thermal waters may rise with much less reduction of temperature, and it is in such situations they occur. There can be little doubt, however, that all these thermal waters suffer a reduction of temperature from an intermixture with cold springs, or surface-water, for it not unfrequently happens, that two contiguous springs vary in temperature.

Temperature of the thermal springs, on the northern side of the Alps:

Leuk, twelve springs, varying in temperature from 117° to 126° Farenheit.
Naters, 86°, much intermixed and variable.
Bagnes, unknown.
St. Gervaise, 94° to 98°.
Aix les Bains, 112° to 117°
Moutiers, 101°
Brida, - 97°
Do. opposite the bath, much intermixed.
Saute de Pucelle, unknown.

The number of known hot springs that break out at the foot of the central range of the Alps, in a line of seventy miles, is a

fact that deserves more attention than it has hitherto received, for it is highly probable, that all these thermal springs derive their heat from one common source, placed at a great depth under the surface, and extending in a direction from N.E. to S.W. nearly in which line we also find the hot springs that have been recently discovered near Grenoble, twenty miles west of Aix. That the thermal waters at the foot of the Pyrenees are connected with the same common source of heat, is not, perhaps, improbable.

The mountains that were on our left hand, in going to Sallenches from Cluse, terminate, in their southern direction, at St. Martin, but they extend easterly towards Servos; and from thence to the mountain called the Buet. They vary in elevation from seven to ten thousand feet, and are capped with strata of limestone, which form mural precipices of vast height. The rock at the feet of these mountains, ranging to Servos, is a dark argillaceous schist, which is quarried, in some situations, for roofing-slate. The road to Servos being cut up in many parts by torrents, we found it desirable to have a guide from Sallen-

ches, who supported the char with his arm, where it might be in danger of overturning. Before arriving at the Lake of Chede, there is a village above the road, called Passy, which is supposed to have been the ancient Vatiscum, mentioned by Pliny, as in the country of the Centrones. Roman antiquities, and *ex voto* inscriptions, have been found here, and a large gold medal of the emperor Trajan, equal in weight to four napoleons. A Roman paved road, considerably above the present road to Servos, was carried along the side of the mountains, the remains of which are still to be seen. It led from the country of the Centrones (which comprised the Tarentaise) into the Vallois. The hill on which Passy stands is under the Aguille de Varens, and slopes down to the south. It is planted with vines and fruit trees, which, owing to their sheltered situation, flourish here even in the face of the eternal snows of Mont Blanc. These are nearly the last vines in the valley, going to Chamouny, which produce what is called by the inhabitants good wine. A little farther we passed a vineyard, which served to shew the power of man to triumph over the inclemencies of the seasons. The culture of this vineyard, owing to the

caprice of a wealthy proprietor, had been entirely neglected for several years, and the vines, left to the sole care of nature, were become so dwarfish, that the leaves resembled in size those of the gooseberry.

About three miles from Sallenches, we stopped to see the Cascade of Chede, which has been much too highly praised; the same may be said of the small Lake of Chede, which is a mile beyond.

The most dangerous part of the road, which is carried a considerable height above the valley, is the passage of a ravine, and the Nant Noir, a mountain torrent, rendered black, by passing over rocks of dark schist. This ravine, which is wide and deep, is partly filled up with masses of rock, that have fallen down from the mountains above. The road and bridge had lately been destroyed by an inundation, and we were obliged o make a considerable détour on foot, while our voiturier conducted the char through the water. This spot has been the scene of many fatal accidents. From hence the road descends to Servos, which is situated in a deep part of the valley, that was once a lake, called the lake of St. Michel, from a castle of that

name, which stands on an eminence on the left. According to tradition, this lake was suddenly emptied by the breaking down of a rock, which formed its western barrier, at a place now called Pertrui. The ancient town of Dionysia, or Diouza, which was situated in the plain, below Passy, is said to have been buried under a heap of sand and gravel by this inundation. A few years since, after an inundation of the Arve, a chimney was seen rising out of the ground, which was supposed to have belonged to one of the houses once in the suburbs of Dionysia, but no search was made to discover the remains of the city.

The mountains on the north of Servos, seem to threaten the town and valley with destruction. Immense mural precipices of limestone, rest on beds of soft and fragile sandstone and schist, which are yielding to the constant action of rains and torrents, and producing frequent eboulements. The most considerable on record was that of 1751. It commenced on a Sunday, when the inhabitants were at church, and continued many days, during which time the air was darkened with immense volumes of black dust, that was supposed at first to be smoke. This dust

extended as far as the Priory of Chamouny, and is remembered by some of the oldest inhabitants. A continued succession of reports, like those of the loudest thunder, or peals of artillery, announced the constant falling of the rocks day and night, but the scene was obscured by the dust. The quantity of fragments which fell was far less than what fell from Mont Grenier, described in Chap. V.; nor was the loss of cattle or of human lives great, considering the extent and duration of this eboulement. A deep excavation under one of the mural precipices, above the valley, threatens the repetition of a similar catastrophe at no distant period.*

The mountains on the north of Servos, particularly le Montagne de Fis, abound in marine organic remains. The first winter we passed at Geneva (1820) I had seen a collection of them in the cabinet of M. Andrew de Luc, which greatly excited my surprise, as they were analogous to those in our upper calcareous formations in England, although the limestone of the Alps had been generally supposed to belong to the lower or transition formation.

* See Note at the end of this volume.

I was desirous to examine the mountains above Servos, but the weak state of my knee rendered it impracticable. I procured, however, a considerable number of fossils from the vicinity, among which were several species of echinites, one of which M. A. de Luc said was an unknown species,

Having now resided more than four months among these calcareous mountains, I had fully convinced myself, that however they may resemble, in their mineral characters, our transition or mountain-limestones, they are in reality the same as our upper calcareous strata, above the coal formation. I was not then aware that any geologist had come to the same conclusion, respecting the calcareous formations of this part of Savoy, but on my return to Paris, M. Brogniart obligingly presented me with his Essay, *Sur les Caractères Zoologiques des Formations*, just then published, in which he has given an able and detailed description of the strata and fossils, in the mountains above Servos. The greater part of the fossils he refers to the green sand under the chalk, though the mineral characters of the strata have, I think, few features of

resemblance. I did not read the essay of M. Brogniart with attention, till my return to England, which I now regret, as I should otherwise have stated to him my opinion, that in classing à part of these strata among the upper calcareous formations, he should also have comprised with them the dark carbonaceous schist on which they rest; as being a lower member of the same series. This soft dark schist, which M. B. classes with transition rocks, and calls a grey-wacke-slate, or in the new nomenclature, *phyllade pailleté noir carburé*, I am fully persuaded is analogous to our lias-clay, and to the aluminous schist of Whitby: like the latter, it contains nodules, with impressions of ammonites, and I have seen it in other parts, where it is frequently coated with a saline efflorescence. It also occurs in a conformable position with the upper beds.

Admitting this to be lias-clay, the analogy between the strata of the Montagne de Fis, and the English series, will, in a great measure, be accordant; and surely if many of the upper calcareous formations of the Alps have the hardness and other mineral characters of our transition limestones, we

may also admit that the schist of the lias, may assume the character of clay-slate, or grey-wacke-slate. The old prejudice about the transition strata of the Alps, still sticks so close to many geologists, that they are determined to find them somewhere, otherwise schist containing ammonites, would not be classed with them. The bituminous schist of Thuringia, containing the vertebral remains of fish, has the character of clay-slate, but I feel fully assured that it belongs to the same formation as the bituminous schist of Whitby; and, like it, this schist rests on red marle, and sandstone, whose geological position is the same as our own red marle. I believe, farther, that all the slate-rocks which contain the remains of vertebrated animals, will be found, when their position is fully and fairly examined, to belong to the lias formation, or the strata above it, and not to any of the transition series. If this be admitted, it would remove much of the perplexity in which the comparative geology of different countries is involved. Some of the schist in the Alps, may be classed with our coal shales, and perhaps a comparatively small portion with the grey-

wacke, and clay-slate of the transition series.

From Servos to Pont Pelissier, a distance of about two miles, we proceeded along the valley of the Arve: the bridge called Pont Pelissier, crosses this river a little below the spot where it issues from one of the most striking chasms or gorges in the Alps. On the eastern side are slate rocks of amazing height, nearly perpendicular, their summits and feet ornamented with pine-trees; and, on the western side, there is a granitic mountain over which, the road is carried. The river Arve, a large and impetuous torrent, rushes between these two ranges of rocks, and towering over the whole, the snows of Mont Blanc are seen in dazzling whiteness, which, contrasted with the dark blue of the sky, almost overpowers the sight. Only a part of Mont Blanc is visible from Pont Pelissier, yet no where in the approach to Chamouny, does it present a view comparable in beauty or sublimity to this.

The rise or Montée (as it is called) from Pont Pelissier is very steep, and is generally ascended on foot. Boys with long mountain horns, stand by the way to awaken

the echoes in the ravine, and elicit money from the pockets of travellers. The rock beyond Pont Pelissier is a remarkable compound of quartz and felspar: the quartz in some parts is the most abundant; it is rose-coloured, and very beautiful: the felspar is a yellowish white. The rock is sound, and is harder than almost any of the granitic rocks on the northern side of the Alps. On the summit of the rocks which overhang the ravine on the east, we saw a few cottages which our guide informed us were buried under the snow, and the inhabitants were cut off from all intercourse with any other village during several weeks in the winter. Their stock of fuel, with potatoes and other provisions for themselves and cattle, were all brought under their roofs at the commencement of the cold weather. The condition of these peasants in winter, can be little better than that of the natives of Greenland, or Kamschatka.

Descending to the valley of Chamouny, we passed a rivulet which we scarcely noticed; but on our return, after a few hours rain, it was become a powerful stream. In this rivulet the father of Dr. Pacard of Chamouny, who first ascended Mont Blanc, was drowned

when crossing it to visit a patient. The road soon after turns to the east, and enters the valley of Chamouny, which is nearly twelve miles in length, and in most parts exceeds a mile in breadth at the bottom, but owing to the great height of the mountains which bound it on each side, the valley appears much shorter and narrower. Pines and larches clothe the lower parts of the mountains, and give a sombre appearance to the western end of the valley, which is rendered still more so by the unvaried snows of Mont Blanc, which hang over it; but after passing the priory of Chamouny, the scene changes, and to this dreary magnificence succeeds a series of majestic pyramids or aguilles of astonishing height, and too steep to admit the snow to rest upon them in any season.

What constitute the chief interest of Chamouny, are the numerous glaciers which descend from Mont Blanc and the mountains on the south, to the very bottom of the valley. No where in the Alps, are they of such magnitude, or approach so far into the regions of cultivation as here; the glaciers in the Berneze Oberland are not to be compared with them,

nor can any description or graphic representation give an adequate idea of the scene.

Could we suppose a torrent, nearly a mile in breadth and several hundred feet in depth, to be descending down the side of a mountain, rolling waves over each other, more than fifty feet in height, and the whole to be instantly consolidated and split into angular fragments on the surface, we might have a tolerably correct notion of a glacier, but without seeing it, we should still have but a feeble conception of the impression that such an object would excite.

The first glacier that descends low into the valley is called the Glacier de Boissons. The ice of this glacier is more pure and unsullied by the fall of earth and stones from the mountains above, than that of any of the others. Among the singular forms of the ice upon its surface, one resembled the steeple of a church. Our guide said it was about fifty feet in height; it had been observed fifteen months, and would probably fall down the following summer.

Nothing respecting the glaciers is more extraordinary or better attested, than the progressive motion of these enormous masses of ice. In order to prove it, marks have been fixed on some of them. Our

guide told me that a block of granite, that had fallen on the Mer de Glace, had been observed to move about three quarters of a league in twenty years; hence the progressive motion of this glacier may be stated at one hundred and eighty yards in a year. It will easily be conceived, that a mass of ice descending into a warm valley would disappear in the course of time, and the valley would be free from ice did not other ice advance to supply its place. The process may be thus briefly stated: the glaciers are principally formed in the high mountain valleys in the Alps, the bottoms of which slope down towards the lower valleys. As the ice at the lower end of the glacier which is exposed to a warm temperature is dissolved, the ice above, as it rests upon an inclined plane, is pressed forward by the force of gravity, and thus the whole is put in motion. By this motion, the ice is often rent with surprising noise. Fissures are made many feet or yards wide and of vast depth, and the surface of the descending glacier is broken into irregular masses, that project a great height above the surface. A newly made fissure may be known by the emerald colour of the ice.

The ice of the glaciers is formed by the consolidation of the snows lodged in the mountain valleys: as the surface of the snow thaws and percolates through the mass, it is again frozen, and acts as a cement, and by a repetition of this process, the whole mass is converted into solid ice; not so compact, however, as that of rivers or lakes, for it is full of air bubbles, owing to the mode of its formation. As the ice descends from the higher into the lower valleys, there is a certain point at which the equilibrium between the two forces, heat and gravity, that act on the glacier, is established — the heat diminishing as much of the ice, as decends into the valley in a given time, the lower termination remains nearly stationary; I say nearly, for after a series of cold seasons, the glaciers enlarge and advance further into the valleys, and after a series of warm summers, they diminish and recede: but, as far as observations have been carried, we are warranted in the conclusion — that on the average of a great number of years, the quantity of ice and snow in the Alps remains the same.

As the glaciers are overhung by lofty

precipices, masses of rock and stones are every year falling upon the surface of the ice, and are carried along by its progressive motion, till they approach the lower extremity. where they fall over. Thus a heap of stones of vast height is formed at the feet of the glaciers. This is called the *Moraine.*

The moraine serves to mark the ancient limits and height of those glaciers that are diminishing, for when the ice retires, it leaves the moraine or heap of stones which it had deposited at its feet, and these remain for centuries incontestable proofs of the former extent of the ice. Where the bulk of the glacier is diminishing, the moraine which surrounds it is higher than the present surface of the ice, though the stones have originally fallen from it; we are therefore certain that the height of glacier must have greatly diminished, since the period when the stones were deposited.

The glaciers that descend from below certain inaccessible pinnacles or aguilles, are loaded with their fragments, and afford specimens to the geologist of rocks which he could not otherwise obtain.

After passing the Glacier de Boissons, we saw a little beyond it the marks of a great inundation, which, descending from the Aguille de Midi under Mont Blanc, had covered several acres of cultivated ground with stones: it took place in the night, about a fortnight before we were at Chamouny. The inundation was so rapid, that in a few seconds it reached to the upper windows of the houses in the valley. A poor woman was in bed with her two children, she caught them up, but before she could make her escape, a log of wood was driven through the roof of the house with such violence, that the youngest child was forced from her arms and was drowned. The torrent had rushed through a forest of pines in its way, and had laid the trees prostrate. It had taken a meandering course through the fields, and had left patches of oats and barley surrounded by heaps of stones of such a depth, that the ground was irrecoverably lost. After accidents of this kind, the peasants all contribute by their labour to assist their unfortunate neighbours in repairing the damages they have sustained; and as such accidents frequently

take place, and every one may be liable to them, they feel a community of interest in aiding each other to the utmost of their means. By common sympathy, an insurance-office is formed, the capital of which is, industrious charity.

Before we arrived at the priory of Chamouny, our guide desired the voiturier to drive on as fast as possible, as some heavy clouds were gathering at the other end of the valley. A tremendous thunder-storm with hail began just as we alighted at our inn, the thunder rolled in reverberated peals among the mountains, and, though very loud, the sound seemed to come from a great height in the atmosphere.

The next morning we visited the source of the Arveiron, a considerable stream which issues from a large cavern in the ice, near the foot of the Glacier de Bois. This glacier is a continuation of the one which in the mountain valley above, is called le Mer de Glace. The mouth of the ice cavern seems small at a distance, but on approaching it, I found it was full sixty feet in height, and more than that in breadth. The river which issues from the cavern, carries off a great part of the lower

water which runs from the glacier, and as the ice of the glacier is in summer continually melting at the bottom, the roof of the cavern would sink to the level of the river, were it not that large segments of ice detach themselves from the upper part of the arch, and enlarge the excavation as much as it is reduced by the dissolving of the lower ice. The progressive motion of the glacier, which I have before described, prevents any diminution of the mass of ice in the valley. The cavern varies in size at different times of the year: in winter it is very small. It changes its position also according as there is a greater or smaller quantity of ice dissolved in the course of the summer. Several glaciers which I have seen in the Swiss Alps have similar caverns; and there was another very large ice cavern at the bottom of the Glacier d'Argentiere, which could not have been in existence when Saussure visited the Alps, for he expressly describes that from whence the Arveiron issues, as the only one of any magnitude at Chamouny.

In some of the small glaciers in the valley above Lauterbrun, I had an opportunity of observing very satisfactorily the formation

of these ice caverns. Where a stream of water of considerable magnitude issues from the ice, it forms an arched aperture, and as the roof of the arch has a tendency to sink, a number of semicircular seams are formed, dividing the ice above into curved strata, which detach themselves in succession, and enlarge the aperture, forming caverns more or less high, in proportion to the mass of ice, and the quantity of water which issues in one stream from it.

One day I walked round the bottom of the Glacier de Bois at Chamouny, to examine its structure more attentively. Where this glacier terminates, it is formed of three distinct beds of ice, with seams of earth between, comprising a total thickness of ice, above the Moraine, of about 200 feet in height, ending in three perpendicular precipices behind each other, over which a very considerable water-fall was passing down into the valley. The length of this glacier is more than seven miles. It divides into two branches above, and is connected with other glaciers. In some parts it is more than a mile in breadth. On the edge of the precipice of ice were several large masses of rock, partly projecting over

it, and while I was attentively viewing the glacier, a stone fell from it, and passed me with great force. We had scarcely removed to the western extremity, when a crash like thunder was heard close to us; our guide returned to see what had taken place, and informed us that one of the masses of rock, which we had seen on the edge of the glacier, had been projected from it, and had fallen close to the place where we had been standing. This glacier has lately been advancing, and had covered an orchard in the valley the preceding spring. A pear-tree was growing almost in contact with the ice.

In 1784, Saussure thought this glacier was receding, and he says that it had once advanced 1300 feet farther into the plain, for he observed a heap of blocks of granite near the village of Tines, which, he adds, had been unquestionably deposited by this glacier, as they are of the same kind of stones that are deposited by it at present. It is well known, that the glaciers bring down fragments from the distant and inaccessible aiguilles that tower over the mountain-valleys in which they are formed, and each glacier has its own rock specimens. Trees

were growing among the blocks of granite near Tines, which proves that they have lain there a long time. It is remarkable that this intelligent observer should have drawn the following conclusions from the stones brought down by this glacier, immediately after describing the deposition of them near Tines. See *Voyages dans les Alpes*, tom. ii. p. 21.

"The blocks of stone, with which the lower part of this glacier is loaded, give rise to an important reflection. When we consider their number, and think that they are deposed and accumulate at this extremity of the glacier, as the ice is dissolved, we are astonished that these heaps of stone are not much larger. This observation, and others which I shall afterwards develope, lead us to believe with M. De Luc, that the actual state of our globe is not so ancient, as many philosophers imagine."

Without entering into the question of the antiquity of the present state of the earth, I cannot avoid expressing my surprise, that M. Saussure did not see, in the very heap of stones he had been describing, an answer to the enquiry, why the accumulated débris brought down

by the glaciers, are not much larger than we find them at present? If the stones near the village of Tines were deposited there by the Glacier de Bois, a heap of these stones must undoubtedly have once extended from near Tines to the present termination of the glacier, for the glaciers recede or advance very slowly, and almost imperceptibly, and they are continually depositing stones from the surface. Now, what has removed the stones which once formed a continued moraine to Tines? We must resort to the known action of water for an explanation, and we are compelled to admit, that the vast inundations, from the rapid melting of the snow, which are frequently sweeping through the valley of Chamouny, are adequate to the removal of a great part of the débris brought down by the glaciers. Or should we say that the Glacier de Bois did not recede gradually, but was suddenly melted by some extraordinary cause, this cause would, at the same time, have thawed all the ice in the valley, and such an immense inundation would have taken place, as must have driven before it the accumulated débris of preceding ages.

In the sand brought down by the glacier de Bois, and spread in the valley by the river Arveiron, particles of gold have been found, but not in sufficient quantity to repay the expence of washing and extracting them, and the search was abandoned.

The spires or pinnacles called *aiguilles*, which rise to such an amazing height above the valley of Chamouny, are composed of nearly vertical plates or beds of granite; and it is most probable that they derive their present form from this structure. That these beds have been raised by some violent convulsion into their vertical position, may, I think, be demonstrated, as I shall endeavour to show in the following chapter. The same force by which the beds were upheaved would, it may be easily conceived, break their edges or summits into irregular forms; and the moisture of the atmosphere, which subsequently penetrated between the perpendicular fissures, would split and disintegrate the masses on their sides, without diminishing much of their height. Perhaps in this manner we may satisfactorily account for the existence of these narrow perpendicular ridges and pinnacles, or aiguilles, that

occur in the valley of Chamouny; whereas we may suppose Mont Blanc to have been raised in one vast mass, less broken than the other parts of the Pennine range; and thus its broad summit admitted the snow to rest upon it, and cover it to a vast depth: this covering protects it from disintegration, at least on the northern side. The southern side of Mont Blanc, facing Italy, is a nearly perpendicular escarpement of bare rock, which must be constantly exposed to the destructive effects of atmospheric agency.

It is possible that the granitic aiguilles may have been shaped into something like their present form by an immense deluge, which swept over the surface of the globe, and transported the fragments of these rocks into distant districts, where they remain, at present, the monuments of some mighty revolution. According to the opinion of Sir James Hall, the blocks of granite, now scattered over the country, were stripped from the Alps, when enveloped in a covering of ice, and were in this manner floated to the places where they are now found. (See *Edin. Phil. Trans.*)

The height of Mont Blanc above the level of the sea is stated to be 15,680 English feet; and as its measurement has been taken, both by the barometer and trigonometrically, we may consider the above as a close approximation to the true elevation of this mountain. Mont Cervin, or the Matterhorn, and Mont Rosa, in the same range, approach nearly to the height of Mont Blanc. The highest mountains in this range of the Alps are uncovered by secondary strata; whereas in the northern or Swiss range, secondary strata cover most of the highest mountains, except the Finesterahorn and the Shriekhorn.

NOTES

TO

THE FIRST VOLUME.

CHAP. I. p. 25.

La Mere Chantal was the grand-mother of the celebrated Madame Sevigné, so well known by her letters.

CHAP. VIII. p. 302.

Temperature of the Earth.

The anhydrous gypsum at Bex, according to the observations of M. Charpentier, combines with water very rapidly; in the Tarentaise this process is slower, for I observed anhydrous gypsum unchanged, in situations where it had been long exposed to the atmosphere. The rapid combination of the anhydrous gypsum with water at Bex must necessarily give out heat, as caloric is evolved in all cases where water passes to a solid state by combining with other substances. This circumstance has been entirely overlooked by philosophers, who refer to the increase of temperature in the salt mines of Bex (ascertained by Saussure) as furnishing proofs of the high internal temperature of the earth. The experiments of Saussure have been regarded as particularly free from any source of error, as there is no metallic decomposition going on in these mines; but this more

powerful cause of the evolution of caloric has not been hitherto noticed, which entirely invalidates all conclusions drawn from the increased temperature in these salt mines.

Chap. X. p. 357.

The eboulement of the mountain near Servos was seen in part by the Italian naturalist Donati. It was reported that a volcano had broken out in the Alps, and he was sent by order of the King of Sardinia to observe it. The following extract of a letter of Donati, inserted in the First Volume of Saussure's *Voyages dans les Alpes*, contains the result of his observations: — "I acknowledge, that though I doubted the truth of the account, nevertheless, hoping that I might be deceived, I hastened with extreme pleasure to observe a phenomenon so extraordinary. After travelling four days and two nights without stopping, I found myself in face of a mountain enveloped in smoke, from which were incessantly falling, day and night, immense masses of rock, with a noise exactly resembling thunder, or a battery of cannon, but much louder. The peasants had all left the neighbourhood, and only ventured to watch these eboulements at the distance of above two miles." The surrounding country was covered with dust, much resembling ashes; in some places, this dust had been carried by the winds to the distance of five leagues. The peasants said, that they had seen at times a red smoke during the day, and that during the night it was accompanied with flames. These assertions made it generally believed that a new volcano had opened; but I examined these pretended ashes, and found that the dust was composed of pounded marble. I observed the smoke attentively, but I saw no flames, and perceived no odour of sulphur; I examined also with care the springs and rivulets, but they presented no indication of sulphurous matter. Persuaded, after these

researches, that there was no volcanic eruption, I passed through the smoke; and although alone and without escort, I advanced to the edge of the ravine. I saw there an immense rock, which was falling into this ravine, and I observed that the smoke was nothing more than the dust arising from the falling of the stones."

Notwithstanding the opinion of Donati against the appearance of flames, in direct opposition to the evidence of the peasants who saw it, I am inclined to believe the testimony of the latter; for I think it highly probable, that at the commencement of the eboulement, when vast masses of rock were striking against each other with inconceivable force, much light might be evolved by the percussion. When masses of ice fall from a great height during avalanches, a strong light has been observed at the moment when the ice struck the ground; now, though this may admit of a different explanation, yet I consider a sudden compression of the particles, to be the cause of the appearance of light in both cases.

END OF THE FIRST VOLUME.

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